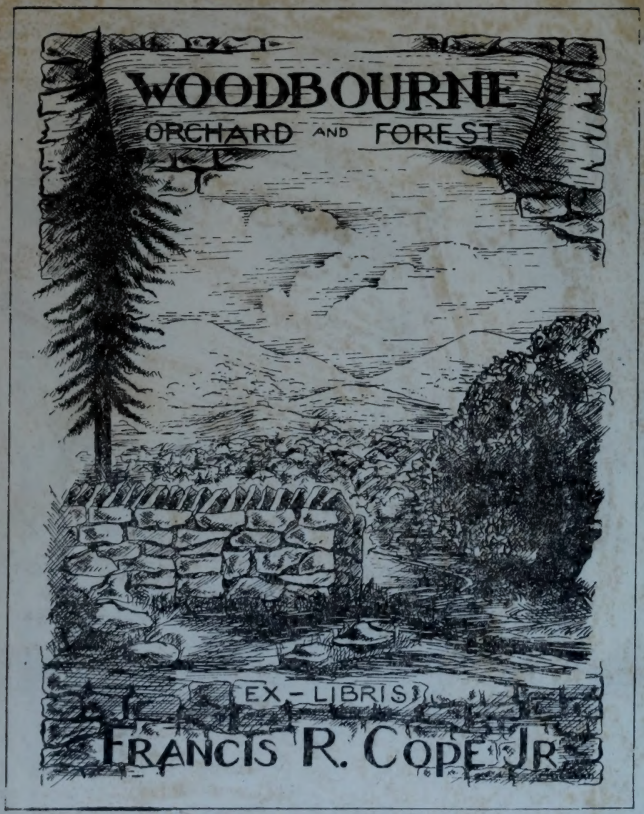
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RURAL PENNSYLVANIA

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Plate I. A farm homestead in Pennsylvania.

RURAL STATE AND PROVINCE SERIES

RURAL PENNSYLVANIA

BY

RALPH L. WATTS, M.S., D.AGR.

Dean and Director of the School of Agriculture and Experiment Station of The Pennsylvania State College

New York

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1925

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PREFACE

This book aims to present a picture, by means of type, of the country life of Pennsylvania, explaining its agriculture, its institutions for the betterment and development of the rural part of the civilization of the State, and forecasting its possibilities.

The title of the book, "Rural Pennsylvania," at once attracted me. It was proposed by Dr. L. H. Bailey, editor of the "Rural State and Province Series," to represent the Keystone State in this important assemblage of reading books. The writer has been honored in the delightful task of preparing the material for the Pennsylvania volume, for this State occupies a position in the union of states in many ways peculiar. However, the subjects discussed, as shown in the table of contents, are so diversified that I secured the hearty coöperation of skilful specialists. Their names and the subjects on which they have written so interestingly are recorded in the table of contents, and the writer most gratefully acknowledges their able assistance. Acknowledgment is also due Editor Bailey, who has made so many valuable suggestions, and Professor J. A. Ferguson, Dr. S. W. Fletcher, Professor R. H. Bell, Mr. C. E. Watts, Mr. George A. Grant, Professor

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R. U. Blasingame, Mr. L. B. Carter, Mr. Seth E. Gordon, Mr. J. D. Hutchison, and Professor E. I. Wilde who furnished photographs. In all instances the graphs were furnished by the authors of the several chapters.

The book is rather unusual in the wide range of subjects discussed, and yet all of the topics relate to "Rural Pennsylvania." The field has not been covered before in one compilation. It is hoped that every chapter will be of real interest to thousands of residents of this State who may desire to increase their knowledge of the agricultural and rural affairs of Pennsylvania, as well as to many readers in other states who may wish to know more about the rural aspects of Pennsylvania and its relation, in these respects, to the sister states.

R. L. Watts.

ACKNOWLEDGMENTS

The purpose of the Rural State and Province Series, as explained by Editor Bailey, is "to present the rural phase of the development of the commonwealths, with so much of the physical setting and history as will make plain the reasons for the present state of the agriculture and country life." All rural America is under obligations to him for the conception that such a series of books should be published, and that he has undertaken the task of assembling and editing the several manuscripts.

In the preparation of material for "Rural Pennsylvania," it was thought best to seek the assistance of specialists, each one being eminently qualified to write the chapter assigned him. The author, who has written only the closing chapter, gratefully acknowledges the cooperation of the following contributors, most of whom found it necessary to devote a large amount of time in assembling data before it was possible to begin actual composition.

Chapter I—Physical and Climatic Setting of Pennsylvania—by E. L. Worthen, formerly Associate Professor of Agronomy at The Pennsylvania State College.

Chapter II—The Soils of Pennsylvania—by E. L. Worthen.

Chapter III—Other Resources of Pennsylvania:

1. The Timber Supply, by J. A. Ferguson, Professor of Forestry at The Pennsylvania State College.

2. Game and Fish, by George R. Green, Professor of Nature Study at The Pennsylvania State College.

3. Mines, by E. S. Moore, formerly Dean of the School of Mines of The Pennsylvania State College.

Chapter IV—Historical Setting—by George F. Zook, formerly Professor of Modern European History at The Pennsylvania State College.

Chapter V—Survey of Agricultural Industries—by Frank D. Gardner, Professor of Agronomy at The Pennsylvania State College.

Chapter VI—Agricultural Industries, Plants and Crops—by Frank D. Gardner.

Chapter VII—Animal Industries—by Frank D. Gardner.

Chapter VIII—Markets and Marketing—by Guy C. Smith, formerly Director of the Bureau of Markets of the State Department of Agriculture, Harrisburg.

Chapter IX—Rural Manufactures—by C. W. Larson, formerly Professor of Dairy Husbandry at The Pennsylvania State College.

Chapter X—Governmental Work for Country Life—by William Frear, formerly Vice-Director of the Experiment Station and Professor of Experimental

Agricultural Chemistry at The Pennsylvania State College. Dr. William Frear died January 7, 1922, only a few weeks after he had completed the chapter.

Chapter XI—Educational and Research Organization—by Thomas I. Mairs, Professor of Correspondence Courses in Agriculture at The Pennsylvania State College.

R. L. Watts.

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RURAL PENNSYLVANIA

RURAL PENNSYLVANIA

CHAPTER I

THE PHYSICAL AND CLIMATIC SETTING OF PENNSYLVANIA

THE State of Pennsylvania is in the eastern part of the United States, occupying what might be called the heart of the Atlantic highlands. Geographically, it is situated between 30 degrees 40 minutes to 42 degrees north, and 75 degrees to 80 degrees 30 minutes west. It is in the same latitude as southern New York and northern New Jersey, Ohio, Illinois, Colorado, and California. In longitude the State compares with western and central New York, with Maryland and Delaware, eastern Virginia, West Virginia, North and South Carolina, and the Bahama Islands. Pennsylvania was the central one of the thirteen original states and, because of this unique position, it very early in its history received the name "Keystone State."

Pennsylvania is rectangular in shape, with a maximum length east and west of 380 miles, and an average width north and south of 150 miles. It

extends across the Appalachian divide and includes the richest mineral section of the eastern states. The

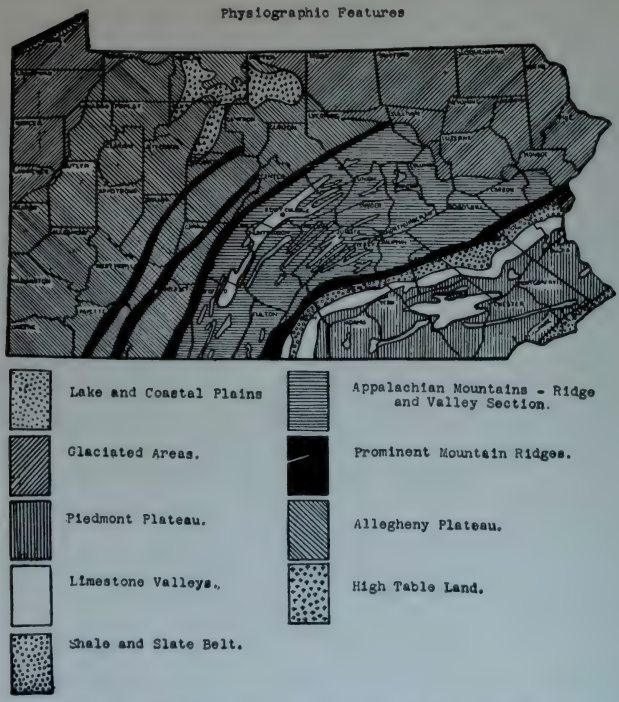

FIG. 1. Physiographic features of Pennsylvania.

State virtually forms the connecting link between the East and the Central West, as well as between the northeastern and the southern states. With the

harbor of Philadelphia on the Delaware Bay and a shore line on Lake Erie, it shares with New York state the distinction of having an outlet on the Great Lakes, as well as the Atlantic Ocean, which is of great commercial importance.

Pennsylvania is bounded on the north by New York state and Lake Erie, on the east by New York and New Jersey, on the south by Delaware, Maryland and West Virginia, and on the west by Ohio. The Delaware River forms a natural boundary on the east, while the Mason and Dixon line separates it from Maryland on the south. To a considerable extent rivers and mountain chains form natural county boundaries within the State.

In size Pennsylvania ranks thirty-first in the Union, and is larger than any of the adjoining states except New York. It is composed of sixty-seven counties varying in size from 130 to 1,146 square miles. Lycoming is the largest and Montour the smallest county. The State contains an area of 44,832 square miles.

Pennsylvania derives its name from its wooded or sylvan area, combined with the name of its founder, William Penn; that is, Penn's woods.

GENERAL SURFACE CONFORMATION

Pennsylvania is primarily a mountainous state. Within its borders are examples of practically every important geological upheaval connected with the formation of the whole Allegheny Mountain system.

It is not surprising, therefore, that the surface conformation presents a diversity of conditions.

The main physiographic features (Figs. 1 and 2) cross the State diagonally in a northeast and southwest direction. They represent in some instances almost continuous mountain ranges, sometimes broad depressed valleys, and again high elevated plateaus, but always extending northeast to southwest. Even the low-lying coastal plains along Delaware Bay and Lake Erie cross the extreme corners of the State in this same general direction. Because of the great diversity in surface conformation, and particularly on account of the complexity of geological forces which have been responsible for the present physiography, it is not easy to get a clear conception of the actual surface features of the State.

While the surface has been subjected to numerous upheavals, with accompanying crumpling and folding, as well as intermittent submersions in past geological times, all of which have left their influence on the surface features, it is well to bear in mind that the existing topography is largely the result of comparatively recent water and ice erosion.

The great ice sheet extended down from the north and spread over extensive areas in the northeastern and northwestern sections of the State. While the glaciers were able to round off the crests of the hills and mountains of northeastern Pennsylvania, and at the same time fill in to some extent the narrow valleys, their force was inadequate to modify materially the surface conformation of this rugged section.

In the four northwest counties the pre-glacial topography was less broken and the glaciers were able to smooth off effectively the elevated areas and to fill in the valleys, thus producing a comparatively level plain with much of the pre-glacial drainage obliterated. Throughout the unglaciated section of the

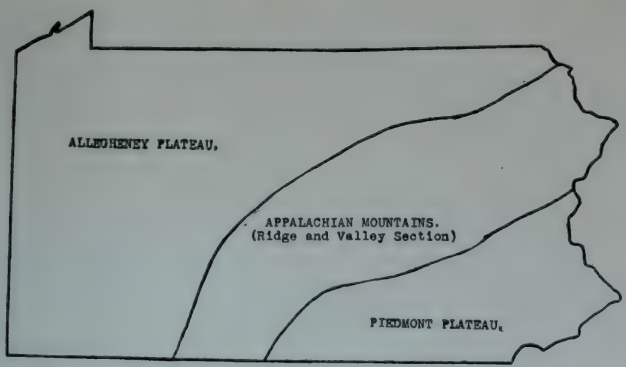

FIG. 2. The three physiographic regions of Pennsylvania.

State, water has had a marked effect on the topography. It has been largely responsible for the wearing down of old mountain chains, resulting in the formation of the present plateaus. Not infrequently these same plateaus have been deeply intersected by stream-cut valleys. Along the larger streams, particularly where they intersect the softer rock strata, wide valleys have been carved out. These valleys often include terraces as well as the present alluvial flood plain.

Broad stretches of exposed limestone and shale have been slowly dissolved away by the chemical action of water, forming here and there over the central and southeastern sections of the State elongated valleys hundreds of feet below their original surface levels.

Viewing Pennsylvania as a whole, the general surface conformation exhibits a diversity of conditions. The most prominent physiographic features are the broad rolling plateaus, the rough and stony mountain chains extending northeast and southwest across the central part of the State, with the broad fertile valleys between, the low level plains along Lake Erie and Delaware Bay, and finally the alluvial valleys and terrace bordering the Susquehanna, Delaware, and other large rivers.

The surface conformations classify naturally into three distinct physiographic regions: the Piedmont Plateau in the southeast, the Allegheny Plateau in the west, with the Appalachian Mountain and Valley section between. Within each of these broad divisions there are wide variations in topography, in the character of soil as well as in agricultural development. In the general classification, the Piedmont section includes, in addition to the true Piedmont Plateau, the narrow remnant of the Atlantic coastal plain adjoining Delaware Bay and also the Great Valley paralleling the Blue Ridge and separating it from the true Piedmont; or more briefly stated, it is comprised of the entire southeastern section of the State lying south of the Blue Ridge. The Allegheny Plateau division includes the western, northern, and

even much of the central part of the State. Its boundaries are restricted by those of the true plateau with the exception of a narrow lake plain adjoining Lake Erie. The southeastern edge of this plateau is marked by a rough escarpment often referred to as the Allegheny Mountains. This plateau front is very distinct as it swings up from Maryland in a great circle well past the center of the State, but, in the extreme northeast section, due partly to the action of the glaciers, this escarpment becomes very indistinct and is often entirely obliterated. Lying between the two plateaus is the third general physiographic division which has been designated as the Allegheny Mountain and Valley section. Needless to say, it is a rough mountainous area consisting of numerous narrow ranges tending to parallel one another in a northeasterly and southwesterly direction. The Blue Ridge Mountains represent the southern extension of this division and separate it from the Piedmont section, while the Allegheny escarpment marks the western boundary and forms the division line between it and the elevated Allegheny plateau to the north and west.

Piedmont Plateau

That section of Pennsylvania lying southeast of the Blue Ridge, and referred to as the Piedmont Plateau division itself, consists of three rather distinct physiographic features: the strip of coastal plain along Delaware Bay; the true Piedmont Plateau to the northwest; and the continuous shale

and limestone trough lying just south of and paralleling the Blue Ridge throughout its course across the State.

The coastal plain area developed in Delaware, Philadelphia, and Bucks counties has a maximum width of ten miles. It presents a comparatively level surface elevated from 100 to 450 feet above sea level, with a very gradual southeast slope.

The Piedmont Plateau proper varies in topography from a gently rolling plain, in a high state of agricultural development, to rough hilly land still supporting native but seldom virgin timber growth. The unimproved areas are commonly so rough and stony that agriculturally they are fit only for pasture or occasionally for the growing of orchard fruits. Not infrequently even in this section forestry affords the most practical means of utilization.

The Piedmont Plateau includes in its broad expanse across the State clusters of low mountain ranges and several level limestone valleys. The South Mountains are the most extensively developed highland of this division. They are from 600 to 800 feet or more in elevation and extend in a more or less irregular manner from Easton to Reading. In fact, isolated clusters are to be found further west in southern Lebanon and Dauphin counties. Locally, these low mountains are known as the Durham and Reading Hills and the Welsh Mountains. The other prominent elevation, called South Mountain, is confined largely to Adams County and represents the northern extension of the Blue Ridge proper.

Of the limestone valleys, the largest is located in Lancaster County and is commonly referred to by the county name. Chester Valley is a well defined limestone depression varying from one to three miles in width, but having a length of fifty miles or more and extending from eastern Montgomery across Chester well into Lancaster County. These, together with other smaller limestone valleys of the true Piedmont, are depressed below the surrounding country. They have a level to rolling topography and contain some of the most valuable agricultural land in the whole country.

Outside of the elevated hills or mountains, as well as the depressed valleys, the Piedmont Plateau presents rolling to hilly topographic features. The general level is 200 to 400 feet above the sea. The surface topography, as well as the elevation, is dependent largely on the character of the underlying rock—the more resistant the rock the higher the plain level, and in general the rougher the topography.

Extending along the northwest edge of this important physiographic division and adjoining the Blue Ridge Mountains to the north, forming practically a continuous trough, lies the Great Valley. It consists of two parallel exposures, one limestone and the other of slate and shale. The former has eroded rapidly and consequently the limestone valley proper occupies the bottom of the trough. The shale has weathered more slowly and presents a surface level several hundred feet above the limestone floor and from a distance has the appearance of a broad

flat terrace adjoining the Blue Ridge Mountains. However, on close inspection it will be found that the surface of this more elevated portion of the valley trough is dissected by numerous small streams, some of which have cut narrow but rounded valleys to a depth of one hundred feet or more.

While over much of this Piedmont Plateau division the surface is rough or at best undulating, a large proportion of the area is in a high state of cultivation. The limestone valleys, as well as the undulating uplands, have a deep covering of fertile soil. In fact, the area as a whole represents not only one of the best agricultural sections of the State, but one of the most productive and highly improved in the United States.

Appalachian Mountain and Valley division

Beginning with the Blue Ridge on the southeast and extending to the western face of the Allegheny Plateau, the Appalachian Mountain and Valley division crosses the State. It maintains a fairly uniform width from fifty to seventy-five miles throughout its course. The area consists of parallel mountain ranges, running in the characteristic northeast and southwest direction, with broad limestone and shale valleys between. In many respects it presents the most picturesque section of Pennsylvania.

Geographically this division represents the weathered remains of a once much crumpled mountain chain. These original mountains consisted of sharp anticlines and synclines with limestone exposure

along the tops of the anticlines. These stretches of limestone, which marked the crests of the original mountains, have weathered rapidly until now they form the low broad limestone valleys running in a northeast to southwest direction between the parallel mountain chains which mark roughly the location of the original valley floors. These mountain ridges are very rough and capped with hard sandstone which has prevented their rapid weathering. Sandstone fragments have often rolled or washed down their sides, covering to a greater or less extent the shale which commonly constitutes their base.

The mountain ridges are invariably narrow with intervening valleys, although occasionally, as is the case in the Seven Mountains, the ranges are so closely grouped that only very narrow ill-defined valleys have been developed. The crests of these ridges present a characteristic even appearance, often maintaining for miles a uniform elevation of around 2,000 feet. They occasionally rise to and maintain for some distance an elevation of 2,400 to 2,500 feet, and an occasional high peak may reach a height of approximately 3,000 feet above sea level. These ridges rise from a height of 600 to as much as 1,500 feet above the floors of the adjoining limestone valleys. Here and there the ridges are entirely severed by stream erosion, producing the beautiful water gaps of central Pennsylvania. In other instances, shallower V-shaped depressions are to be seen in these mountain ridges. These are often spoken of as wind gaps and very probably represent stream action at some early period

in the erosive process of formation. Of these numerous parallel ridges the following are among the most prominent: Bald Eagle Range, Nittany Mountain, Tussey Mountains, the Seven Mountains, Jacks Mountain, Tuscarora Mountain and finally the Blue Ridge at the extreme southeast. Of the intervening limestone valleys, the Nittany, Penn's, Kishacoquillas and Morrison's Cove are the largest.

The anthracite coal region is confined to the northeastern part of this Mountain and Valley division of the State. In this section, in fact over much of the area north and east of the Susquehanna, the valleys are very distinct and never of limestone derivation. The higher elevations present a plateau-like topography and there is virtually no line of demarcation between this eastern extension and the true Allegheny Plateau. In fact, the high broken uplands of northern Monroe and Carbon counties, together with those of Pike, Lackawanna, and southern Wayne and Wyoming counties, are often considered part of the Allegheny Plateau division. While much of this area has been glaciated, the smoothing effect of the ice was inadequate to change materially the rough topography. In fact, over much of this whole country east of Columbia County, the surface has been found too rough and rugged to permit of any real agricultural development.

The Allegheny Plateau division

The Allegheny Plateau lies to the west and north of the Appalachian Mountain and Valley division

constituting the extreme western extension of the Atlantic Highlands. In total area, it constitutes over half the State. It consists of an elevated plateau dipping perceptibly to the north and west and extending well into Ohio, West Virginia, and Maryland.

The eastern edge of this broad plateau is marked by a well defined escarpment known as the Allegheny front. It is badly eroded along much of its expanse, producing a mountainous topography responsible for its being popularly referred to as the Allegheny Ridge. This escarpment enters Pennsylvania in Somerset County, follows closely the county boundary between Cambria and Blair as well as that of Somerset and Bedford, then across Center, Clinton, and Lycoming counties until it becomes obliterated in the rough broken section to the east. The plateau front, or the crest, of this eroded eastern wall has an elevation at the Maryland line of approximately 2,800 feet above sea level. It dips slightly to the northeast, being 2,200 to 2,300 feet in Center County, and continues to dip gradually until it becomes indistinct in western Lycoming County.

Over much of its extent in Pennsylvania, the Plateau is between 1,000 to 2,000 feet in elevation. While the 2,000-foot level is commonly exceeded along the eastern front, it drops to around 1,200 to 1,300 feet throughout much of the bituminous coal region south and east of Pittsburgh. Along the Ohio line the elevation is from 900 to 1,000 feet. There is a well defined table-land in Elk, McKean, and Potter

counties that is distinctly of higher elevation than the general plateau level, being from 2,400 to 2,500 feet above the sea. At one point in Potter County, this elevated area forms a local divide between the Atlantic, the Great Lakes, and the Mississippi. Due to the high elevation and rough topographic surface, this table land is of little agricultural value and is largely covered with timber growth. Laurel Hill and Chestnut Ridge are other elevations worthy of note, which stand out distinctly above the plateau level. These two ridges, entering Pennsylvania in Fayette County, extend almost parallel to each other well into the central part of the State. They are anticlinal ridges, being similar in character and having the same general direction as the numerous ridges in the Mountain and Valley division. Like them they are steep and stony and are still well forested with second-growth timber.

The topography of the Allegheny Plateau section is rolling to decidedly hilly. On casual inspection there is little resemblance to a true plateau, as the streams have so frequently carved out deep narrow valleys and the divides have been likewise rounded by constant erosion throughout a long period of years. To the careful observer, however, the outline of the original gently sloping plain is clearly discernible from almost any well elevated position within the area.

With the exception of the three elevated areas already described, the roughest topography is along the escarpment and extending a few miles west over

the elevated plateau front. The plateau becomes less rugged and gradually more rolling to the west. In the five southwestern counties of the State the plateau is badly dissected by the Ohio, Allegheny, and Monongahela rivers and their tributaries.

The glaciers pushed down into the northwestern section of Pennsylvania, modifying somewhat the surface of the Allegheny Plateau. The area thus covered is confined largely to Erie, Crawford, Mercer, and Lawrence counties. The ice invasion did not materially alter the general plateau level but smoothed down the hills and filled in the valleys to some extent. It distributed rather uniformly over the area a sheet of deep glacial till. Associated with this glaciated area of the Plateau is the narrow lake plain in northern Erie County. This is a low level stretch bordering Lake Erie and representing what was at one time the bed of the extended lake.

THE STRUCTURAL GEOLOGY

The geology of Pennsylvania consists, in the main, of a succession of land upheavals accompanied by considerable warping, interspersed with long epochs of surface erosion and even periods of submersion below the sea. It has been subjected to practically all the geological forces and agencies which have played a part in the formation of the great Atlantic Uplands. Within its borders are to be found remnants of old pre-Cambrian formations down through the list of various geological periods to the advent

of man. Few states present such a complexity of geological formations as Pennsylvania. Needless to say, this brief discussion of the geology can touch only some of the more important factors which have directly or indirectly influenced the agriculture of today.

The Piedmont Plateau presents one of the oldest known geological formations. In the South Mountains there is preserved a remnant of the pre-Cambrian uplift which was exposed to a long period of weathering. This lasted until the end of the Lower Silurian era, when a second upheaval elevated what is now commonly known as the old Appalachian Mountain system. These mountains have slowly weathered away until today this geological formation is represented by the higher plateau level of the Piedmont. The rocks of this formation consist largely of gneisses and schists, while various igneous as well as metamorphic rocks occur in the South Mountains. The soils of this section have been derived through rock weathering in place and consequently the character of the parent rock has exerted a direct influence on the type of the resulting soil.

During Triassic times a low elongated trough extending from northern New Jersey across Pennsylvania and south as far as North Carolina became submerged. The material deposited in this elongated depression has given rise to the reddish-brown strip of sandstone, shale, and conglomerate extending southeast from northern Bucks County to the Maryland line in southern Adams County. The surface

level of this formation lies perceptibly below that of the older more resistant igneous and metamorphic rocks, but still well above the adjoining limestone valleys. The topography, while more rolling than that of the valleys, is less broken than in the section derived from the older rocks.

The limestone valleys (Fig. 3) within the Pied-

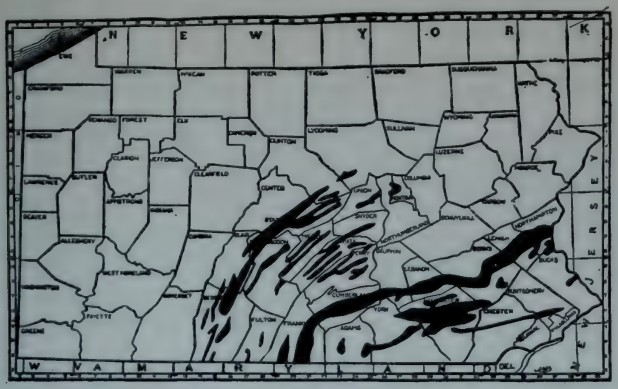

FIG. 3. The black areas show the fertile limestone valleys.

mont proper, as well as the Great Valley along the northwest border, are of Silurian derivation and consist largely of Trenton limestone. This limestone varies somewhat in character, but it generally runs high in carbonates and has been extensively burned as a source of agricultural lime. In the Lancaster Valley, south from the city of Lancaster, there is a large area of this limestone which contains a percep-

tible proportion of mica and becomes somewhat schistose in character.

The Great Valley, forming a continuous depression across the State and extending south through Maryland, Virginia, and into Alabama, consists, in Pennsylvania, of two distinct geological formations. The valley proper is of massive Trenton limestone, while the higher area between this and the Blue Ridge is composed of Utica and Hudson River slates and shales. The weathering of both the shale and limestone has given rise to productive soils throughout the area in Pennsylvania and in its southern extensions, the Hagerstown Valley of Maryland, and the Shenandoah of Virginia. The Great Valley has long been renowned for its virgin fertility.

The Blue Ridge, which marks the eastern edge of the more recently formed Allegheny Mountain and Valley section, is composed largely of Medina and Oneida sandstones and shales. These same rocks occur here and there throughout the central division of the State. They often outcrop as a narrow strip well up the mountain slopes and are of too rough a topography to be of great agricultural value.

This Mountain and Valley section consists largely of Silurian rocks, including in addition to limestone, shales, sandstones, and conglomerates. The limestone valleys of this region, like those of the Piedmont, are most commonly derived from Trenton limestone, though the Helderberg appears in somewhat restricted areas. Of the sandstones the Medina occurs most extensively, while in case of the

shales the Clinton, Niagara, and Salina formations are all developed. Various Devonian formations of both shale and sandstone outcrop along the lower edge of the Allegheny escarpment, while both the Cambrian and Carboniferous ages are represented. The rocks of this section class almost entirely as sedimentary. The geological derivation has not been as influential in affecting the resulting soil as was the case in the Piedmont Plateau.

The Allegheny Plateau is composed of sedimentary rocks of the Carboniferous age. The original floor of this vast plateau consisted of alternate layers of sandstone, shale, limestone, and conglomerate laid in an almost horizontal position. Later the east edge of the plateau was perceptibly elevated, producing the west to northwest slope, so evident today.

The Pottsville conglomerate formed the original surface over much of this plateau in northern and northwestern Pennsylvania. It is still found commonly as the surface formation, although very often it has been entirely removed and the underlying Pocono sandstones replace it as a surface covering. The thin bed of shale which separated these two harder formations has apparently had very little influence on the present soil condition of the area, much of which has distinct agricultural value.

In the deeply dissected parts of the plateau, these surface layers have been entirely eroded through, exposing the Catskill and sometimes in the deeper cuts even the Chemung formation. The soils of the valley slopes are often made up entirely of residual

material from the Catskill formation. Under such circumstances, the soil itself possesses the characteristic red color of the parent Catskill shales and sandstones. The Chemung reaches the surface only on some of the low valley floors, being covered largely by alluvial material, and has not been influential in the formation of the present soil.

South from Forest, Venango, and Mercer counties, the Pottsville and lower formations dip and become hidden by the successive appearance of more recent formations to the south. Of these the Allegheny extends east and west across Lawrence, northern Butler, Clarion, and Jefferson counties. South of this, extending to Pittsburgh and southeast, the Conemaugh appears as the surface formation; then the Monongahela in southern Allegheny, northern Washington, and eastern Westmoreland and Fayette; and finally in southern Washington and Greene the Dunkard is the almost universal surface formation.

The lower geological formations from which the soils of the northern Allegheny Plateau have been formed consist of sandstones, conglomerates, and noncalcareous shales. The Conemaugh, Monongahela, and Dunkard, on the other hand, consist partly of limestone or calcareous shale. Consequently, in the southwestern section of the State, the soils are influenced by limestone. This is particularly true from Pittsburgh south, where the higher lime-content of the soil has produced a condition favorable to Kentucky blue-grass pastures, red clover, and even alfalfa. The development of the sheep and beef cattle in-

dustry in Washington, Greene, and Fayette counties reflects the natural adaptability of the soil to bluegrass pastures and legume hay.

The narrow plain along Lake Erie, as well as the northern extension of the Atlantic Coastal Plain along Delaware Bay in the extreme southeastern part of the State, are of Tertiary formation. They consist of unconsolidated deposits of silt, sand, and gravel belonging geologically to the Pleistocene age. In case of both these low-lying plains, the old shore lines are distinctly marked by a sharp rise in elevation. In the plain along Lake Erie, various old beach lines are still clearly discernible today. The surface material here consists largely of reworked glacial débris, while that of the plain along the Delaware is made up largely of alluvial wash carried down by the Delaware River.

The glacial epoch

During the Ice Age of the North American continent, the southern extension of the great continental ice sheet pushed down over New York State well into Pennsylvania (Fig. 4). It carried with it great masses of rock particles, varying in size from the finest silt particle to huge bowlders. This débris consisted almost entirely of local rock material picked up as the ice crossed over southern New York or even as it spread through northern Pennsylvania, but it included also igneous and metamorphic rocks transported from much farther north.

The southern limit of the glacier is marked by a

terminal moraine consisting of a ridge built up by the accumulation of the débris which had been pushed ahead of the advancing ice. In some instances this moraine is very distinct, while at times it is so ill-defined that it is not easy to determine the exact southern limit of the ice advance. Where north and south valleys occurred near the terminus of the

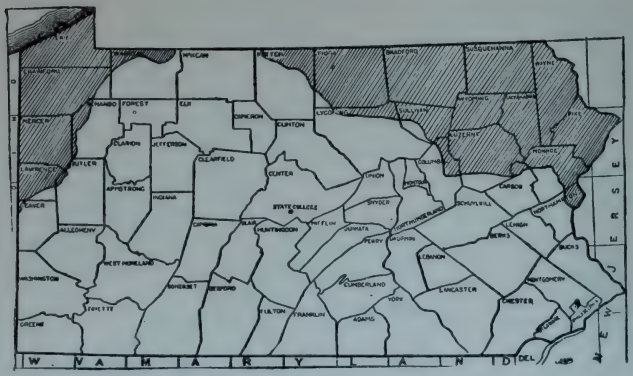

FIG. 4. The glaciated areas are shown in the northeast and northwest parts of the State.

glacier, great tongues of ice were forced down them for a considerable distance to the south of the upland moraine. As the glacier slowly retreated, due to the ice melting back more rapidly than it was moved forward, the accumulation of rock débris was gradually deposited in a continuous layer. Where for any reason the retreat was temporarily checked or particularly in case of a slight temporary advance, small

morainic ridges were formed, thereby interfering with the deposition of a uniformly thick till sheet.

This deposition of fragmentary material modified considerably the character of the surface of the land covered. The glacial till not only varied in its original thickness but, due to unequal subsequent erosion in certain areas, has been removed more completely than it has in others. Nevertheless, over most sections, except where the topography is very steep, it still remains as a surface covering to a depth of several feet.

There is wide variation in the character of the débris deposited. Over some areas it consisted almost entirely of clay, silt, sand, and gravel, in others it included good sized bowlders. In certain sections these large bowlders have been strewn so thickly as to render the cost of removal prohibitive. It is not uncommon in the glaciated section of northeastern Pennsylvania to see fields placed under cultivation only after most laborious effort had been expended in picking off the rounded bowlders.

That the ice sheet advanced with real force is evidenced by the fact that its progress was not stopped by the Allegheny Mountains. It passed entirely across the eastern extension of the Mountain and Valley section of the State, and in Northampton County it broke through the Blue Ridge and entered for a short distance into the slate and shale section of the Great Valley. This ice sheet had a marked smoothing effect on the topography of all the section covered. Unfortunately, in northeastern Penn-

sylvania the pre-glacial topography was so rough that even with its enormous smoothing effect it was unable to modify materially the broken surface. However, in the northwestern part of the State where the pre-glacial plateau surface was less broken and the ice sheet apparently thicker, the hills were worn down and the valleys filled so effectively that a comparatively level, inadequately drained plain was left when the ice receded.

Through the glaciated sections the pre-glacial drainage was somewhat modified. Over much of Erie, Crawford, and Mercer counties it was entirely obliterated and has had to be replaced by entirely new post-glacial drainage systems. In the northeast section the pre-glacial drainage was modified somewhat and numerous lakes formed through the hill sections of northern Monroe, Pike, and Wayne counties. During the period of glacial retreat streams were called on to handle large volumes of water. As a result, the water rose in them to a high level, and, as it was heavily laden with glacial débris, broad alluvial plains were formed. Later these same streams, much diminished in volume, gradually cut narrower channels into their broad plains, thereby leaving these alluvial glacial deposits as elevated terraces.

Here and there through the glaciated area of the State, glacial-formed ridges and hills are to be seen. Among these are typical eskers, kames, and occasionally drumlins, that represent dumps of glacial till, sometimes stratified, at other places not depending on

the mode of deposition. Not infrequently where such formations exist the glacial débris has accumulated to a thickness of twenty-five to fifty feet. Altogether the advance of the ice sheet proved to have a beneficial effect, but it was unfortunate, from an agricultural standpoint at least, that it could not have smoothed down more effectively those more rugged sections over which it passed.

DRAINAGE SYSTEMS

Pennsylvania, situated on the divide not only between the Mississippi and Atlantic basins, but also including small areas draining through the Great Lakes into the St. Lawrence, presents an intricate and somewhat complicated drainage system. In most instances the drainage is maturely developed. The larger streams almost without exception follow courses well developed in previous geological epochs. The smaller tributaries have generally been able to work their way back into the divides so that almost a perfect network of surface drainage has been evolved. Due to the uneven character of the surface over much of the State, the run-off at times becomes excessive, causing serious soil erosion. The removal of the virgin timber covering, particularly in the Allegheny section, has materially intensified the spring freshets, with the result that almost every year the streams reach a flood stage accompanied by serious damage to the agricultural lands within their valleys. Not only has the timber removal intensified

the spring floods, but likewise it has lessened the summer flow, so that many of the smaller streams now become dry in seasons of drought.

There are three main drainage systems in Pennsylvania. Two, the Delaware and Susquehanna, flow

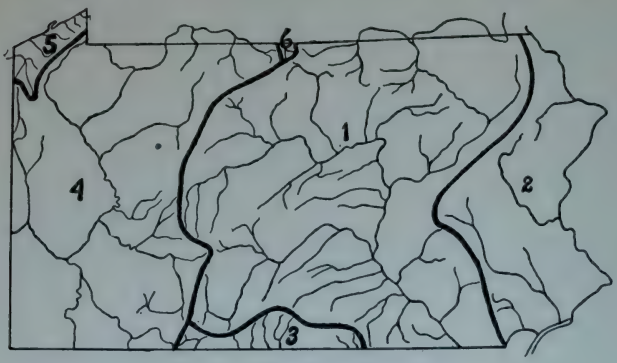

FIG. 5. Drainage basins.

Atlantic Ocean: 1, Susquehanna River; 2, Delaware River; 3, Potomac River. Mississippi River: 4, Ohio, Allegheny, Monongahela and tributaries. Great Lakes: 5, Conneaut and other small creeks; 6, Genessee River.

to the Atlantic, while the third, the Ohio, and its tributaries, drains west into the Mississippi Basin (Fig. 5). Separating this east and west drainage is the great Atlantic divide crossing the State from the north to the south. Beginning at the north, the high table-lands of Potter, McKean, and Elk counties form the water-shed. To the south a somewhat less elevated section of the plateau extends south and east

forming the divide until the high crest of the Allegheny front is reached in eastern Cambria County, which from there to the second line separates the waters flowing east to the Atlantic from those draining west through the Mississippi to the Gulf of Mexico.

There are also three minor drainage basins, the larger of which is centered in southern Franklin, Fulton, and Bedford counties. It drains south through the Potomac into the Atlantic. The other two belong to the St. Lawrence drainage basin. The one in Erie and northwestern Crawford counties drains through numerous small streamlets into Lake Erie, while the other of even smaller extent in northern Potter County has its outlet through the Genessee into Lake Ontario.

The Piedmont Plateau division is drained both by the Delaware and its tributaries and the Susquehanna. Here the main drainage channels cut directly across the various geological and physiographic belts, which extend diagonally through the State. Neither the soft formations of the strip of Triassic material nor the trough of the Great Limestone Valley have been adequate materially to modify this drainage which had its main channels so completely developed in previous geological uplifts. Even the Blue Ridge proved an inadequate barrier, for not only the two main rivers of the section but likewise the Lehigh and Schuylkill have maintained narrow steep-walled gorges or water-gaps, as they are locally termed, through the formidable mountain ridge.

From the sharp bend at Trenton, the Delaware River has abandoned its old channel which extends on east across northern New Jersey, and follows a newly formed valley to the south. It is this geological phenomenon that made possible the formation of a deep water way so essential as an adequate harbor for the city of Philadelphia. After the change in the course of the Delaware, when the area was somewhat more elevated than it is today, the river eroded a wide deep valley to the sea. With the subsequent depression of the land surface, the waters of the Atlantic entered this valley, forming what is now the Delaware Bay. Due to the adequate carving out of this lower Delaware Valley and its subsequent depression below sea level, combined with a tide which reaches to the city of Trenton, Philadelphia has an Atlantic seaport second only to that of New York, even though located more than one hundred miles from the sea.

The Appalachian Mountain and Valley section of the State lies largely in the Susquehanna basin. This river not only cuts through the Blue Ridge but in a similar manner through range after range that lie parallel in this central section, and finally the West Branch intersects the elevated front lands of the Allegheny Plateau and drains an area of this physiographic division in Clearfield and some of the adjoining counties. The Juniata is the most important tributary of the Susquehanna and, like its parent, cuts directly through several of the mountain ridges. The east branch of the Susquehanna follows

well the general surface contour as far north as Wyoming County, where it makes a direct swing to the left and enters the Allegheny Plateau proper. The streams of this section are very beautiful.

While the main streams more commonly follow inherited courses, the smaller tributaries of more recent origin tend to parallel the ridges, following fairly well the valleys themselves. They, also, have developed numerous small tributaries which flow in direct courses from the mountain sides. This rather unusual type of stream arrangement so characteristic of the section south and west of the Susquehanna, as a drainage system has been termed by geologists "grapevine pattern."

Almost all of the western section of the Allegheny Plateau of Pennsylvania lies in the Ohio Basin. Here the streams are of a meandering type. They have effectively worked their courses back practically to completion, so that today over much of the plateau an almost perfect drainage system has been developed. The Allegheny, Youghiogheny, and Monongahela form the main arteries of drainage. They are well intrenched in old valleys which have undergone little change in position since the early drainage system was developed following the initial uplift of the plateau. Occasional remnants of an old terrace level about one hundred feet above the present valley floors may be seen, but on account of their limited extent they have little agricultural significance.

The intrusion of the ice sheet over the four border counties south of Lake Erie has considerably modified

the drainage of this area. The pre-glacial drainage has been to a large extent obliterated by a thick deposit of till, and sufficient time has not yet elapsed since the glaciers for the adequate development of a complete natural drainage system. Rather extensive poorly drained areas occur along the divides in Crawford and Mercer counties, particularly between the streams flowing north into Lake Erie and those into the Allegheny River and Beaver Creek to the south. The drainage problem is intensified by the frequent occurrence of an impervious layer of compact silt and clay in the subsoil. Consequently it is not surprising that artificial drainage has in many instances been resorted to in the agricultural development of this glaciated section.

The limestone valleys of the State present an interesting as well as an effective system of natural drainage. To a large extent these areas are drained by underground streams flowing through caves or caverns which have been weathered out of the limestone rock by the chemical action of water. The crests or roofs of these underground passages have often caved in, forming the so-called surface sinks so prevalent in practically all the larger limestone valleys. In many localities the sinks are so numerous that the water readily finds its way to these depressions and disappears into the underground drainage systems. In some instances surface streams flow into these sinks, forming underground streams, only to appear again a mile or more farther on to continue as surface drainage ways. Occasionally well-formed

valleys occur without any stream. In this case, underground streams have developed which have robbed the surface valley of its water supply.

Needless to say, the farm lands within these limestone valleys possess almost perfect drainage. Even though the water percolates readily down to the underground channels, the soil and subsoil are heavy enough to withstand droughts.

CLIMATE OF PENNSYLVANIA

The climate of Pennsylvania, while presenting perceptible variation, is typical of that common to the northeastern section of the United States. The temperature variations are not great and are influenced more by altrtude than by differences in latitude. It is also noticeably modified in both the southeast and extreme northwest by the proximity to large bodies of water. The northeastern part, as well as the high elevated sections of central and southern Pennsylvania, have a climate not dissimilar to that of the New England states, while south and east of the Blue Ridge it is much warmer, approaching in mildness the states of New Jersey, Delaware, and Maryland.

The rainfall is fairly uniform over the State. It is well distributed throughout the year, although crops are frequently injured somewhat by late summer droughts. The average annual precipitation is somewhat over forty inches, while the growing season over much of the State exceeds 150 days.

The mean annual temperature of Pennsylvania ranges from a little less than 44 degrees in the extreme northeastern corner to 54 degrees in Philadelphia, Montgomery, Delaware, and York counties. This difference is due fully as much to the effect of altitude as latitude. The effect of altitude on the

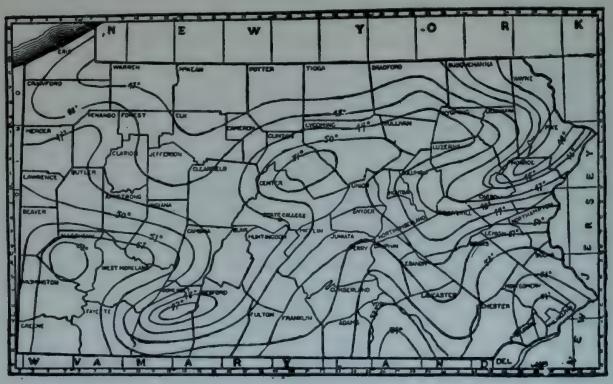

FIG. 6. Showing the average mean temperature of different parts of the State.

temperature is remarkably well illustrated by comparing the mean of 47 degrees in Somerset County, where the altitude is well over 2,000 feet, with that of 54 degrees at approximately the same latitude in Philadelphia County, but where the altitude is less than 400 feet. The difference of over five degrees in mean temperature between central Somerset and Fayette counties, a distance of not over forty miles,

emphasizes the effect of elevation on the temperature (Fig. 6).

The influence of Lake Erie as a modifying agency on the temperature is very perceptible. The average mean temperature of 49 degrees which is reached at the lake shore, seldom reaches the extreme southern extension of the northern tier of counties. Even more pronounced is the influence of Lake Erie on the length of the growing season. In the lake plain the average date of the last killing frost in the spring is at least ten days earlier, and of the first killing frost in the fall fifteen to thirty days later than in the northern tier of counties to the east. This gives an average growing season adjoining the Lake of approximately the same duration as in the extreme southeastern part of the State.

The minimum winter temperature recorded for the State was January 5, 1904, at Smethport, where the thermometer reached the minimum of 42 degrees below zero. The maximum summer temperature was 108 degrees recorded at Claysville, Washington County, August 6, 1918. The winters are perceptibly milder in the southeastern and southwestern parts of the State, but the summers are noticeably hotter than in the higher elevations in central and northern localities. Severe extremes of temperature seldom occur either in winter or summer in any section of Pennsylvania.

There is considerable deviation from normal in the dates of the first and last killing frosts. Except in the northern section of the Allegheny Plateau, there

is little danger from frost after May 15 and in the extreme southeast and southwest parts of the State May 5 and even earlier dates commonly mark the period of extreme late spring frosts. It is of interest to note that the elevated section of southern Somerset County, even extending over the Maryland line, may expect as late frosts as any other section of the State.

The growing season varies from less than 140 to over 200 days. Potter and Tioga counties have the shortest growing season, while Philadelphia with parts of Bucks, Montgomery, Delaware, York, and Adams have the longest.

Over the State as a whole, the rainfall will average well over 40 inches annually, with a variation from less than 34 inches in Blair to over 50 in parts of Somerset and Schuylkill counties (Fig. 7).

There are four areas in which the average annual rainfall falls below 40 inches. The largest of these, and the one having the lowest precipitation, is in the northeastern part of the State, including Bradford, Susquehanna, Sullivan, and Wyoming, as well as parts of all the adjoining counties. Another area is in the center and south center of the State, the third in the vicinity of Pittsburgh, while the fourth occurs as a narrow strip along the lake in Erie County. Throughout much of southeastern Pennsylvania the normal precipitation is in excess of 45 inches. A less extended area of over 45 inches rainfall occurs in Indiana, Cambria, Somerset, and Westmoreland counties. Over the remainder of the State, which

represents fully 50 per cent of the total area, the average falls between 40 and 45 inches annually.

The table in Appendix A, giving monthly temperature and precipitation figures at several represen-

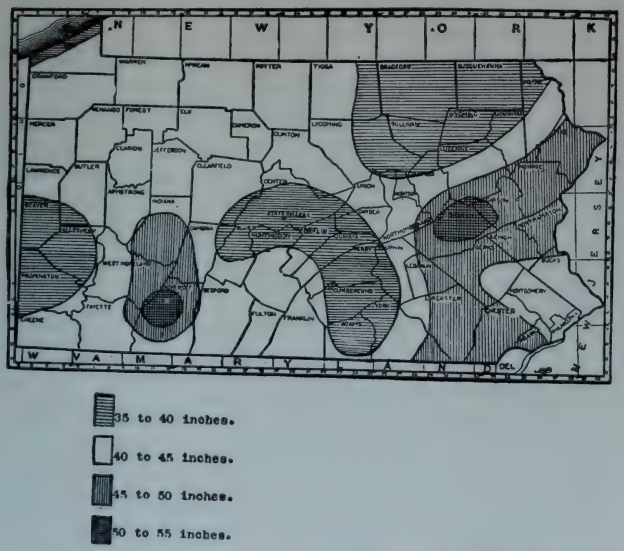

FIG. 7. Showing the rainfall in each section.

tative points in the State, furnishes specific information relative to distribution of rainfall and seasonal variations in temperature.

The snowfall varies in the different sections, depending particularly on elevation and amount of winter precipitation. In the more highly elevated

areas the winter precipitation consists largely of snow, and in such sections the ground is normally covered with a snow blanket the greater part of the winter. Winters with a perceptible amount of rain are not uncommon in the lower altitudes, particularly in the southeastern district, where the tempering effect of the Atlantic Ocean is an additional influencing factor. Occasional abnormal winters occur with much of the precipitation in the form of rain, or where the snow melts periodically, so that in either case the ground is left bare during severe cold weather. During the so-called "closed winters" snow frequently accumulates to such a depth and drifts in such a manner as to make it difficult to keep roads open for traffic.

While the distribution of the precipitation varies somewhat from year to year, in the normal year, as determined by an average over a long period, the maximum comes during the growing season from June 1 to September 1. The winter months are normally the driest. Occasional local droughts occur, particularly in the late summer and fall, while occasionally crops are injured over a perceptible area on account of insufficient moisture.

The prevailing winds are from the southwest. Storms normally approach from west and southwest, accompanied by easterly winds. The areas of low pressure giving rise to the rain and snowfall originate in distant storm centers, reaching Pennsylvania only after passing over states to the west and south. Fall, winter, and early spring rains are often of

several days' duration, but a perceptible amount of the summer precipitation is in the form of showers, although an occasional continuous rain can be counted on during the growing season.

Over the State as a whole the climatic conditions are exceptionally favorable for the development of a greatly diversified agriculture. In fact, a careful survey of the agriculture of Pennsylvania reveals many instances in which the climate, together with the more important factors of soil, topography, and industrial development, has played a part in molding the types of farming. Even so, the climate not infrequently becomes a controlling factor in the production of crops and sometimes is directly responsible for a crop failure.

In the development of the fruit industry, due attention has been paid to climatic condition. An oversight of this important factor has brought disappointment to many growers in the past. It has been found particularly important with the more tender fruits, like the peach, to select a location well above the valley floor where late spring frosts are less likely to occur. At the same time, care should be taken to avoid exposed and highly elevated areas. It has been necessary, also, to choose locations unfavorable to early blooming. Even with the more hardy fruits, like the apple, care should be exercised in the choice of the location of the orchard (Figs. 8 and 9).

In the sections of a relatively short growing season, corn is less extensively produced for grain, and

the flint replaces the dent varieties. Buckwheat becomes of considerable importance in sections with a limited growing season. The cool nights so common over much of the State are favorable to potato production.

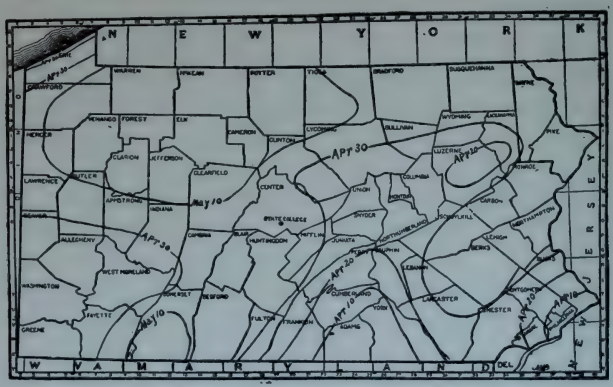

FIG. 8. Showing the average date of the last killing spring frost in different parts of the State.

Fall-seeded grains are well protected through most winters by a snow blanket, although occasionally serious heaving results from the alternate freezing and thawing of the unprotected moist soil. Alfalfa and even red and alsike clover may, when both the climatic and soil conditions are unfavorable, heave seriously.

Over much of the State the growing season is not sufficiently long to favor the growing of catch-crops

and winter cover-crops. In the extreme southeastern section this means of maintaining soil organic matter is utilized. In fact, occasionally frost comes early enough to injure the regular crop. Corn and buckwheat are most liable to injury by fall freezes. The hail storms are not common and always re-

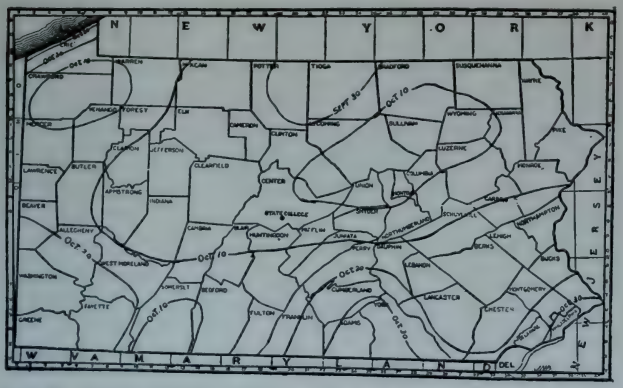

FIG. 9. The average date of the first killing autumn frost in different sections of Pennsylvania.

stricted in extent. They have been known to do very serious local damage. The tobacco crop in particular is subject to severe injury from hail.

It is on account of insufficient rainfall at critical periods that the climate is most often responsible for limiting crop production. Even with the large total yearly rainfall and its usual satisfactory distribution, there are times when crop yields are directly influenced by a moisture deficiency. This is

usually the result of local variation in the rainfall, although occasionally it is due to seasonal fluctuations.

Difficulty is often encountered in seeding spring crops at the most favorable date on account of cold wet weather in the late spring. This is particularly true in the more elevated sections where the growing season will not permit of any material fluctuation from the normal spring planting dates, as well as in the districts in which the soils are not properly drained.

New seedings of grass are often injured by continued dry weather just previous to the small grain harvest. In such cases timothy is less severely injured than clover, with the result that even the first-year grass which has received insufficient moisture in its early stages of growth will consist largely of timothy. In seasons of exceptionally well distributed rainfall, a good second cutting of hay may be made from the better soils. First-year grass, particularly where there is a good proportion of red clover, gives a worth-while aftermath when the late summer rainfall is normal. The yield of alfalfa subsequent to the first cutting is dependent largely on the amount and distribution of the rainfall. The returns from the pastures of the State are, at least during the late summer, largely dependent on rainfall, and not infrequently an inadequate amount of rain necessitates considerable supplementary feeding.

Even though unfavorable extremes occur in both

texture and precipitation, the climate is exceptionally well adapted to a diversified agriculture. The summers furnish a sufficiently long growing season for the maturing of practically all crops common to the northern states without being uncomfortably hot over any perceptible period. At the same time, the winters are not unduly cold nor otherwise disagreeable. The rainfall is well distributed throughout the year. The period of sunshine is about normal for the eastern United States and the storms are seldom severe. All in all Pennsylvania possesses an exceptionally pleasant climate and one well suited for crop production.

CHAPTER II

THE SOILS OF PENNSYLVANIA

The soils of Pennsylvania are extremely diversified in character. Practically all the soil conditions characteristic of the timbered areas of humid regions are to be found within the boundaries of the State. While the silt loams and loams are most extensively developed, the surface soil presents all variations from a compact heavy clay to an open friable sand or even gravel.

Over much of the State residual soils predominate. Such soils have been formed by the direct weathering of the original rock material. They occupy the same position as did the parent rock and resemble it in their physical and chemical make-up. In the glaciated sections transported soils are found. Here the material from which the present soil has been derived was moved by the glaciers. While it contains some material carried down from Canada, it consists mainly of the shales and sandstones of the locality, or of similar rocks transported from the adjoining sections of New York.

Transported soils are also found along the flood plains and terraces of the streams. These soils,

which have been deposited by running water, are termed alluvial and are invariably productive when adequately drained. The area adjoining Delaware Bay as well as the narrow plain along Lake Erie consists of transported soils. The soils of the former area represent the deposition of material washed into the Atlantic Ocean and are known as sedimentary; while those in the plain of Lake Erie are composed of material deposited in the old extended lake, and are called lacustrine soils.

Pennsylvania was originally covered with a dense forest growth. As a result, the surface soils were not abundantly supplied with organic matter. They are commonly gray, yellow, and light brown in color. It is only in areas of poor natural drainage that black surface soils have developed. The soils of the limestone valleys, due to their higher lime-content, are more adequately supplied with organic matter than are the upland soils of the State. Unfortunately the original organic matter content of the surface soils has often been depleted by exhaustive systems of soil management.

The topography has been an important factor in the utilization of the soils. Over vast stretches the surface is too rough and broken to permit of any real agricultural development. This uneven topography has prevented a uniform distribution of railroads and at the same time has made the construction of wagon roads very difficult. The high stone-content of the top soil as well as the frequent proximity of bed-rock to the surface has often been a detri-

mental factor in the agricultural development, particularly in the more broken sections.

Due to the uneven character of the surface, natural surface drainage has been well developed. With few exceptions the drainage systems are old and well established. In fact, from an agricultural standpoint, the surface drainage can well be considered excessive, as it has been largely responsible for the present rough topography over much of the State. In the glaciated sections, particularly in the northwestern counties, surface drainage is not perfectly developed. This, together with the impervious subsoil so common to this northwest section, makes artificial drainage desirable. Small areas of poorly drained soil are found along many of the streams and occasionally along the lower slopes of the hills where, in wet seasons, underground water emerges and interferes with crop production.

The soils bear a very close relation to the geology and physiography of the State. Where shale and fine-textured sandstones occurred as the original surface formation, silt loam and clay loam soil are present. Where coarser-textured sandstones or igneous rocks occurred, the resulting surface soils are loams or sandy loams. In the limestone valleys as well as on the limestone uplands of the southwestern districts the soil is heavy in character, varying from a silt loam to clay. As the topography becomes rough, the influence of surface erosion is more evident. This action has left a thin, often stony, surface covering on the slopes and hill-

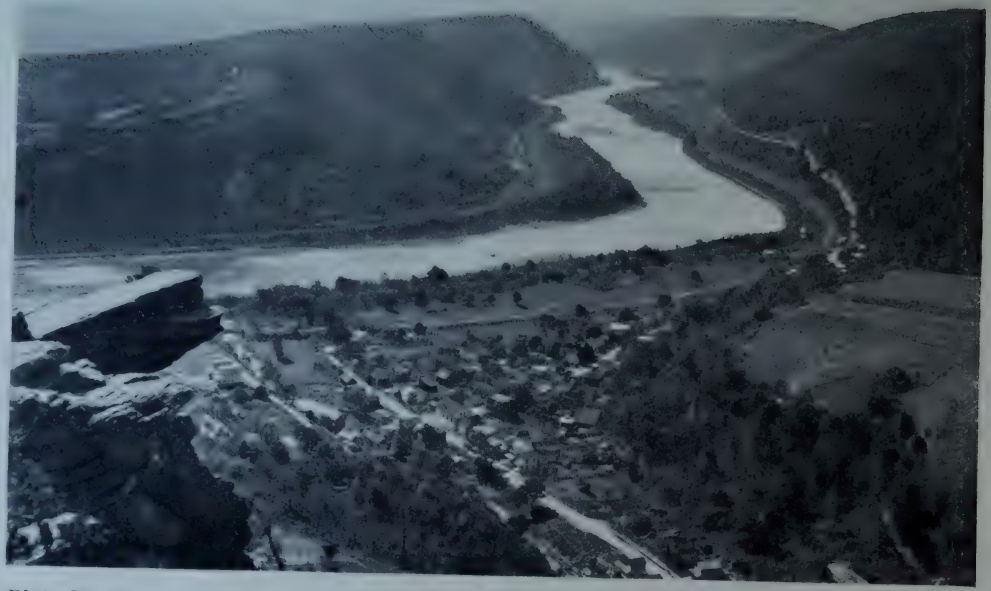

Plate II. Scene in the hard coal region showing the north branch of the Susquehanna River.

tops, while in the depressions there is a deep accumulation of fine-textured soil.

The agricultural development has been influenced by the soil characteristics. Where the topography is rough, or the stone-content of the surface soil is high, development has been retarded. Practically all the land fit for agriculture has been cleared and utilized. Not infrequently attempts have been made to farm land that should have been left in timber. In the limestone valleys the farms are well improved. Here a combined grain and live-stock system of farming is followed. Dairying is developed more or less throughout the State, due to the fact that most of the soils are well adapted to pasturing. Vegetable crops are grown extensively, and especially on the sandy soils. Most of the upland soils are adapted to fruit production and the industry is well developed in certain sections where, in addition to a suitable soil, the climate is favorable. The commercial production of grapes is confined largely to a narrow belt along Lake Erie, though they are grown to a considerable extent in Allegheny County. Due largely to the adaptability of the soil to Kentucky blue-grass, the sheep and beef cattle industry is of special importance in the extreme southwestern corner of the State.

The soils of the eastern section of the United States have been classified by the United States Bureau of Soils into seven broad divisions known as provinces. The separation is based largely on the general physiographic features, although it takes

into consideration the forces of soil formation as well as their influence on the character of the resulting soil. The provinces are: Piedmont Plateau, Atlantic and Gulf Coastal Plains, Appalachian Mountain and Plateau, Limestone Valley and Upland, Glacial and Loessial, Glacial Lake and River Terrace, River Flood Plains. Pennsylvania is the only State in which all seven of these soil provinces occur.

Within the province soils are classified into series. A series includes soils similar in origin, alike in color of both surface soil and subsoil, and not dissimilar in drainage and general surface conformation. The series is again subdivided into types. This type separation is dependent entirely on texture, that is, the size of the soil particles and relative proportion of the different sized groups entering into the soil make-up. The series is named for some geographical or political division of the section where first encountered in the progress of the soil survey. The Penn series of the Piedmont, for example, was named for the State, while the city of Hagerstown, Maryland, furnished the name of the most extensive series of the limestone valleys. In addition to the series name, the type includes a term descriptive of the texture. For example, the Penn sandy loam and Hagerstown silt loam are types of the two series mentioned.[1] In the general or reconnoissance soil survey of the State the series

[1] Bull. 96, U. S. Bur. of Soils, contains detailed explanation of soil classification and nomenclature.

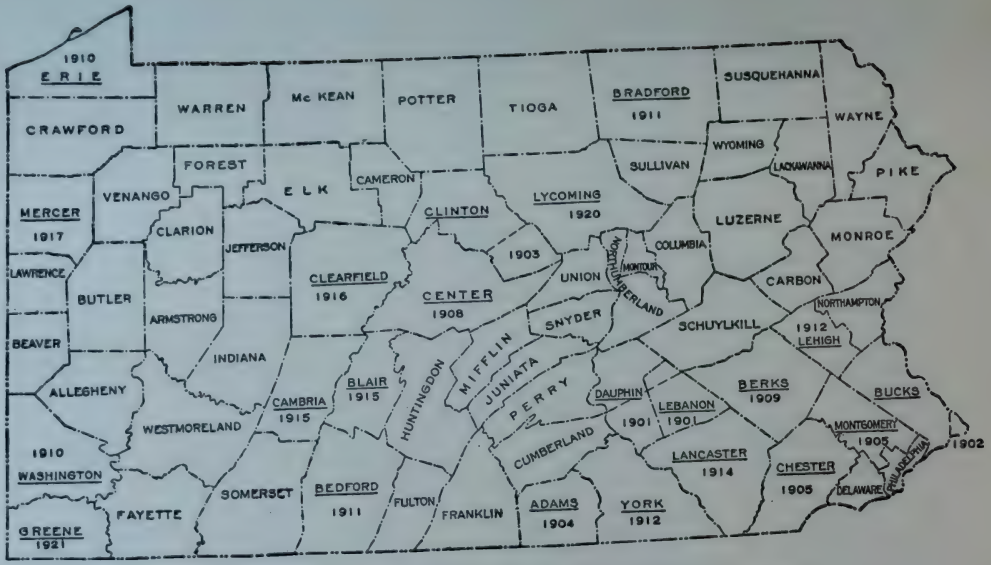

FIG. 10. Counties in which the soils have been surveyed.

has been used as the unit of classification, while in detailed county surveys separations are made on the basis of soil types.

The United States Bureau of Soils, in coöperation with The Pennsylvania State College, has completed the reconnoissance survey of the State.[2] A number of the counties have been mapped in detail (Fig. 10), and the reports are, in many cases, still available for distribution. The names as well as the location of the counties surveyed are indicated on the accompanying map. The number following the county name refers to the Annual Report of the Bureau of Soils Field Operations in which the county report is published.

The area of the more important soils of the State is tabulated as follows in Bulletin 132 of the Pennsylvania Station:

SERIES	ACRES	PER CENT
DeKalb (Including much rough mountain land)	12,541,312	43.5
Lordstown, Volusia, Wooster, Canfield, Trumbull (With considerable rough stony land)	5,614,656	19.4
Westmoreland	2,453,184	8.5
Hagerstown	1,265,536	4.3
Upshur (Considerable rough stony land)	980,663	3.4

[2] The Reconnoissance Soil Survey Reports of Pennsylvania are published in the *Field Operations of the Bureau of Soils* for the years 1908-09-10-11 and 12. Bull. 132 of the Pennsylvania Station consists of a brief summary of these reconnoissance soil surveys.

SERIES	ACRES	PER CENT
Chester	876,672	3.0
Berks	821,376	2.8
Penn	684,992	2.3
Lackawanna	661,440	2.3
Manor	320,384	1.1
Brooke	312,768	1.1
Wheeling and similar Terrace soils	299,072	1.0
Lansdale	292,032	1.0

Remainder 6.3% composed of 34 series.

SOILS OF THE PIEDMONT PLATEAU

The soils of the Piedmont Plateau are truly residual in character. They have been derived by the gradual weathering of the original surface rock strata accompanied by comparatively little lateral movement of the soil material. The character of the present soils can be attributed largely to those of the parent rocks.

The geological formations are the oldest in the State. The rocks themselves are diversified in character. They consist largely of igneous and metamorphic rocks with considerable areas of shales, sandstones, and conglomerates. A high mica-content is characteristic of many of these rocks, and as a result the soils and subsoil of the section are frequently very micaceous in character.

Water has been of some significance in determining the character of the soil. The finer particles have been carried from the surface soil into the subsoil with the result that the upper strata are of a lighter more friable character than the lower. In those instances in which the topography is more

broken, the surface material has constantly been removed, exposing the heavier clay subsoil or, in some cases, bed-rock. A high stone-content is often found in the top soil of those areas which have been subjected to surface erosion.

The soil material has, in most cases, accumulated to a thickness of ten feet or more, although fragments of the parent rock are commonly found within a few feet of the surface. The top soil is often so stony that it is unfit for the production of field crops. However, it can still be utilized for pastures, unless so stony as to be fit only for forests. In the original agricultural development of this section considerable labor was expended in picking the larger stones from the surface.

Considering the Piedmont as a whole, it classes agriculturally as the most highly improved section of the State with the exception of the limestone valleys. The soil was originally productive and it has received exceptionally careful treatment. Attention has been given to the production of clover which enters the rotation regularly. Lime and fertilizer have both been extensively used, and the farm manure has been well utilized.

The Chester and Manor soil series have been derived from igneous and metamorphic rocks. The former consists of a brown surface soil with a yellow to yellow-brown subsoil. The Chester soil is of high agricultural value, well improved and is adapted to the production of general farm crops, including both alfalfa and clover. This soil ranks

as one of the best in the State. The Manor series has a gray to light brown surface soil and a yellow subsoil. It commonly has a high mica-content. The soils in this series are of less agricultural value than Chester soils and are largely utilized for the production of general farm crops.

The Penn series predominates in the area of Triassic formation. It is derived from red sandstone, shale, and conglomerate, and has a brown-red top soil with a deep dark red subsoil. The loam, sandy loam, silt loam, and gravelly loam are the predominating types. This soil is well drained and only occasionally too rough for cultivation. It has a high agricultural value, and is adapted to a diversity of crops. The Lansdale and Lehigh are minor series of similar origin. In agricultural value they are inferior to the Penn soils.

The Mont Alto series, which is derived from trap rock, occurs in comparatively small areas. This soil is heavy or clayey in character and is especially valuable for fruit production.

Other minor soil series of the Piedmont Plateau are Edgemont, Herndon, and Conowingo.

SOILS OF THE ATLANTIC COASTAL PLAIN

The narrow strip of the Atlantic and Gulf Coastal Plain province extending along Delaware Bay, across Delaware, Philadelphia, and Bucks counties, is made up of sedimentary soils. The soils of this area consist largely of material carried down by the Dela-

60045

ware River. The topography is level to rolling. The soils are silt loams, sandy loams, and sands with sandy and gravelly subsoils.

The Sassafras series is the only one of importance. It consists of a yellow-brown surface soil with yellow to reddish-yellow subsoil. The sandy loams and sands are exceptionally well adapted to truck crops. However, the area is largely utilized for the production of field crops. Draining is practiced extensively in this section of the State.

SOILS OF THE LIMESTONE VALLEYS

The limestone valleys of Pennsylvania have long been renowned for their productivity. The agriculture is well developed and the farm improvement seldom equaled over as extensive areas. These rich valley lands were prized by the original settlers and were cleared and put under cultivation at an early period in the agricultural history of the State.

The valleys are the result of the rapid weathering of the limestone. They are not commonly occupied by large streams. In fact, in some instances the drainage is entirely through underground channels. The topography is generally undulating to rolling and the drainage always adequate. Occasionally the bed-rock outcrops on the steeper slopes and in the valleys west and north of the Blue Ridge the proximity of the limestone to the surface frequently interferes with tillage and is the cause of a somewhat droughty soil condition.

The soils are exceptionally well adapted to pasture grasses. Kentucky blue-grass and white clover grow naturally. Red clover, timothy, and alfalfa thrive on these limestone soils. Not infrequently the lime has leached from the top soil to such an extent that artificial liming must be resorted to for red clover and particularly for alfalfa.

Corn, oats, and wheat are extensively grown, while barley is of minor importance. The four-year rotation of corn, oats, wheat, and grass, consisting of clover and timothy mixed, is extensively followed on these limestone soils. Tobacco is an important crop in the large valley crossing Lancaster County. Tree-fruits, particularly apples and cherries, are extensively grown. Potatoes are produced for home use, and, on the lighter soils, as a commercial crop. Practically all the farms are well stocked. While dairying is the most important live-stock industry, hogs, beef cattle, and some sheep are raised. Market-gardening is also followed to some extent.

The Hagerstown soils are the most extensively developed. They can well be considered as constituting the typical limestone valley series. The surface soil is brown to yellowish or even reddish-brown in color. The subsoil is yellow to red and rests directly on the undecomposed limestone.

The silt loam is the most extensively developed type. Along the ridges and on some of the slopes where surface erosion has gone on in the past, clay areas are found. On the steep slopes the bed-rock outcrops or sufficient amounts of rock fragments

occur in the soil to produce stony loam or even small areas of rough stony land.

The Conestoga series, confined largely to the south central part of Lancaster County, is derived from schistose limestone. It differs from the Hagerstown in that it has a large amount of mica in both surface and subsoil. The silt loam is the predominating type. The Conestoga soils are adapted to the same crops as the Hagerstown. Potatoes do somewhat better while tobacco is not so extensively produced. The agricultural value is about the same as that of the corresponding Hagerstown types.

The Frankstown series has a gray to gray-brown surface soil with a light yellow subsoil. It has been derived from an impure limestone with a high content of chert. The soil itself contains a considerable amount of chert and impure limestone. Much of the series has been classified as stony loam. It is well drained and particularly suited to fruit, especially apples.

The Duffield, Decatur, Murrill, and Athol are other limestone valley soils that are of minor importance.

SOILS OF THE APPALACHIAN MOUNTAINS

The Appalachian Mountain section of the State is very rough and the agriculture largely confined to the valleys lying between the mountain ranges. The troughs of these valleys are generally occupied by limestone soils already described. However, between

these true limestone soils and the rough stony lands of the mountain chains there are strips of various widths derived from the weathering of shales and sandstones. In some instances limestone does not appear on the valley floors. Instead, the sandstone and shale-formed soils extend across the depression.

Cultivated areas are found on the elevated sections of mountain ridges where the soil is also derived from shale and sandstone.

The DeKalb and Upshur are the two important agricultural series other than those of limestone derivation which occur in the ridge and valley section of the State. The former consists of gray surface soils with yellow subsoil, while the latter series is distinguished by its characteristic dark red color. These series are deficient in lime and organic matter and are often very stony in character. They make only fair pastures unless given a liberal treatment of lime and acid phosphate. Along the slopes seepage water from the adjoining mountains causes a poorly drained condition. The red Upshur soil is somewhat more productive than the DeKalb but, due to the rougher topography and more serious erosion, it could hardly be considered of greater agricultural value.

Hay is the most important crop produced on these soils. On account of insufficient lime, red clover is largely replaced by timothy and alsike. On the old meadows weeds frequently predominate over grass and clover. While wheat, rye, buckwheat, and potatoes are grown to some extent, the rotation

of corn, oats, and mixed hay is the common cropping system. The yields are perceptibly lower than on the limestone soils. Much of the area occupied by these series is in pasture, while the rough mountain land is heavily wooded.

Falling within this division is a continuous strip of shale adjoining the Blue Mountains on the southeast and extending across the State from Northampton to Franklin County. Geologically this area is considered as part of the Great Valley. The soil classifies as the Berks series. It is fairly productive, well drained, and only moderately rolling in character. The surface is of a gray to gray-brown color with a yellow subsoil. Silt loam with a high shale- or slate-content is the most important type. It is adapted to the grain and hay crops common to the State, and is without question one of the best potato soils in Pennsylvania. The farm improvements are good and the agricultural value approaches that of the Hagerstown soils.

SOILS OF THE ALLEGHENY PLATEAU

The unglaciated area of the Allegheny Plateau occupies about one-third of the total acreage of Pennsylvania. The surface is deeply dissected by stream erosion. In fact, the plateau level is discernible only to the careful observer. In many sections the topography becomes virtually mountainous in character. This is true of the high plateau area in Potter, McKean, Elk, Cameron, and the northern

part of Clearfield County. The eastern edge is very rough, giving rise to the Allegheny Mountains, while both Chestnut Ridge and Laurel Hill extend well across the area north and south. To the west the plateau dips and the surface gradually becomes less rugged in character, but is still of distinctly hilly topography.

The soils are of a characteristic gray to gray-brown color. The subsoil is typically yellow, although occasionally mottled with gray. In general, the drainage is good though seepy areas occur along the lower hillsides. Surface erosion often becomes serious unless the slopes are kept in grass. The stone-content of the top soil frequently interferes with tillage operations.

The DeKalb series is the most extensively developed. It is derived from the weathering of shale and sandstone. As described under the Appalachian Mountain division, this series has a gray surface soil and a light yellow subsoil. It is deficient in lime and organic matter and responds readily to applications of a phosphoric fertilizer. The silt loam type predominates. It is utilized largely for the production of hay and for permanent pastures. Corn, oats, wheat, rye, potatoes, and buckwheat are important crops. Dairying has been extensively developed, and where the farm manure is well cared for and its use accompanied by that of lime and a phosphatic fertilizer, the soil invariably produces good crops.

The Westmoreland series replaces the DeKalb in

the southwestern corner of the State. There is no distinct line of demarcation between these two soil conditions. In fact, the only noticeable difference between them is the higher lime-content of the Westmoreland and the effect which it has on the crop adaptation and agricultural value. The Westmoreland is naturally a more productive soil than the typical DeKalb. It is preëminently better suited to pastures. On it Kentucky blue-grass replaces the Canada blue-grass and red-top, which are indigenous to the DeKalb soils. Due to the excellent pastures on Westmoreland the sheep and beef cattle industries have been developed in Greene, Washington, Westmoreland, and Fayette counties.

Associated with the Westmoreland soils is an upland limestone series called the Brooke. It commonly occupies the hilltops, where a thick layer of limestone has partly weathered down. The soil is heavy in character, being a clay loam to clay. The surface is reddish-brown in color, with a red subsoil. It is somewhat heavy to handle but is very productive when properly tilled.

GLACIAL SOILS

The great continental ice sheet extended well into the northeastern and northwestern sections of Pennsylvania. It materially modified the soil conditions of the area covered. The northeastern extension of the ridge and valley section was so rough that the smoothing effect of the moving ice was inadequate

to influence materially the topography. However, where it pushed down over the northern extension of the Allegheny Plateau, it effectively rounded off the hilltops and filled in the valleys, resulting in a much more favorable topography. The pre-glacial drainage was partly obliterated and in the more level areas post-glacial drainage has not fully developed. Consequently, in these sections artificial drainage has been required for the most satisfactory agricultural development.

In the Reconnoissance Survey all the gray soils of the glaciated areas were classed as Volusia, but now they are recognized as several well-defined series. The Volusia is a soil condition which has a comparatively low agricultural value. The heavy impervious subsoil, with its characteristic gray color, is the distinguishing feature of the series. The surface soil is gray to gray-brown in color and generally silt loam to clay loam in texture.

The Wooster series has a gray-brown surface soil and a yellow subsoil of an open friable structure. It is more productive and far better drained than the Volusia. The Canfield series is intermediate between the Volusia and Wooster. It has a fairly friable subsoil of a yellow and gray mottled color. In the flat undrained areas a very gray soil is developed known as the Trumbull. It is of little agricultural value and, where cleared, is used largely as pasture.

The Lordstown series is extensively developed in the glaciated area in the northeast section of the

State. It, also, has a gray top soil and a yellow to yellow-gray subsoil. This subsoil is fairly open and friable. The series occupies hilly areas and generally has a high stone-content. The bed-rock is invariably close to the surface and the glacial material largely of local origin. Associated with Lordstown and other gray soils of this northeast glaciated area are the red Lackawanna soils. These represent the glaciated equivalent of the Upshur series of the Appalachian Mountain division of the State. They are shallow soils derived from the local red shales and sandstones.

The glaciated soils are utilized largely for the production of hay and as permanent pastures. The dairy industry is developed throughout the area and dairy products are depended on for a cash income. Hay is also shipped in considerable quantities. Little corn is produced except for silage, although in the less elevated areas some is grown for husking. Buckwheat is produced more extensively than in other parts of the State. Oats constitute the chief small grain, while some rye, wheat, and barley are produced. Potatoes are an important crop in certain sections. The soils in general are well adapted to potato production.

Considerable areas in Pike, Wayne, Lackawanna, Wyoming, and Luzerne counties are too rough and mountainous for agricultural development. Forestry appears to be the only logical means of utilizing these rough stony areas.

The glacier advanced over the Blue Mountain in

northeastern Northampton County and extended into the shale and slate belt to the south. This has given rise to a small area of the Dutchess series. The glacial action was feeble and deposited material was largely the local shale, so that the resulting soil is very similar in character and agricultural value to that of Berks series adjoining.

Peat and muck have accumulated in many undrained areas in the glaciated part of the State. Most of such areas are still undrained, but occasionally they have been improved and are being utilized in the production of muck-land vegetable crops. Corn and hay are grown on some of these areas.

Practically all the glaciated section is badly in need of lime. The rejuvenation of clover through the application of lime and a phosphatic fertilizer would materially aid in the improvement of the soils. Coupled with the dairy industry and the careful conservation of manure, this treatment has given excellent results on many farms.

GLACIAL LAKE SOILS

A narrow strip of glacial lake soil extends across Erie County adjoining the lake. This soil occupies the old extended lake-bed and consists of clay, sands, and gravel. Terraces mark the location of old shorelines.

The soils belong largely to the Dunkirk series. The top soil is typically light brown in color with

a yellow to yellow-brown subsoil. In the poorer drained areas this subsoil is of a gray color.

East of the city of Erie the surface soil is sandy and gravelly in character, while to the west the clay and clay loam predominate.

The sandy and gravelly soils are utilized in the production of fruits and vegetables. Grape-growing is an important industry from Erie east. Precisely the same soil conditions obtain as in the Chautauqua grape belt to the northeast. In addition grapes, peaches, and bush-fruits are grown on these sandy soils. They are also used for the production of vegetables. Much of the produce is sold to local canning factories.

On the heavier Dunkirk types such general field crops as corn, oats, wheat, and hay are produced. These heavy soils are often poorly drained and until artificial drainage systems are installed maximum results cannot be secured.

RIVER BOTTOM AND TERRACE SOILS

Alluvial deposits have been formed along practically all the streams of Pennsylvania. In case of the small streams, such deposits are largely subject to annual overflow. Even along the major streams the so-called first bottoms are at least liable to periodic inundation. In no instances have broad flood plains been developed. The streams have been well intrenched in comparatively narrow valleys.

Old elevated terraces occur along some of the

streams of the State. The terrace soils along the Susquehanna are of sufficient extent to be of real agricultural significance. The more extensive areas are along the West Branch in Lycoming and Clinton counties. Here the terraces are level and above the ordinary flood stage of the river. Remnants of more elevated terraces are occasionally discernible.

The first bottom land soils are universally poorly drained except along some of the larger streams. Being subject to overflow at seasons of heavy rainfall, crops are always liable to serious injury on these alluvial soils. The soils are deep and under favorable conditions would be very productive. They are made up to a large extent of surface soils washed from the uplands and deposited in the stream valleys.

The terrace soils are invariably better drained than those of the present flood plains. They are generally sandy or gravelly in character and have a high agricultural value. Unfortunately they are not extensively enough developed to play any material part in the agriculture of the State as a whole.

CHAPTER III

OTHER RESOURCES OF PENNSYLVANIA

PENNSYLVANIA was rightly named "Penn's Woods," for originally it was almost covered with dense forests. It is very probable that none of the other eastern states had forests more heavily timbered. In the pine and hemlock forests, in certain favorable situations, as high as one hundred thousand board feet to the acre are said to have been cut.

The forests were characterized by the large number of species of trees. Situated midway between the northern and southern boundaries of the country, Pennsylvania forms the meeting ground between northern and southern trees. The white pine, hemlock, and spruce from the North mingle with the yellow poplar, cucumber, and gum from the South. From forty to fifty species are often found within the same forest region. The forests of the State were famous, also, for the large size and the soundness of timber of individual trees. It is said that the finest white pine lumber ever cut was taken from the Pennsylvania forests from certain trees that had grown among the hardwoods and had attained large

size with perfectly even grain. In the same forests were trees that made the finest spars because of their perfect form and cleanness of bole. The hardwood trees of southern Pennsylvania were famous for their magnificent proportions and for soundness of wood.

Because of the mountainous character of the central part of the State, as compared with the less rugged country to the east and west, there are three natural divisions of the forest. In the eastern section grow oaks, hickories, chestnut, elm, white ash, black walnut, basswood, and other valuable hardwood trees. There is a similar hardwood forest west of the mountains, composed practically of the same species but mixed in different proportions, together with a few trees typical of the Mississippi Valley region. Through the central part of the State along the mountains and valleys grows a coniferous forest of pine and hemlock mixed with the characteristic hardwoods of more northern regions, such as the hard maple, beech, birch, black cherry, and many others which creep down along the mountains. Many of the trees found in the other regions are also present.

These forests formed a great storehouse from which the early settlers obtained their supply of wood material and which for years placed Pennsylvania among the foremost lumber-producing states. Because of the accessibility of the forests, owing to the large streams which, with their tributaries, penetrate nearly all parts of the State, the timber was

early exploited and soon came to be cut in very large amounts. In the early days, logging was carried on only in the winter time. The trees were cut in the late autumn and early winter, so that the logs would be ready for hauling out to the streams in time for the spring freshets, which were relied on to carry the logs down to the main rivers. This work was done largely by farmers who lived in the vicinity of the forests. After the harvest was over, these men would go into the woods and spend the winter getting out the logs and constructing rafts of them to be floated down to the mills.

The rivers in those days were the great highways of commerce. The products of the forests and mills were made up into rafts and floated down to market. A great industry employing thousands of men grew up around the rafting of logs. As many as 2500 rafts are said to have been floated down the Susquehanna River in one season.

In the western part of the State the Allegheny and Monongahela rivers afforded the means of rafting large quantities of timber to the saw-mills. The lumber manufactured was then taken to market through the Ohio and Mississippi rivers. Because of the nature of the rivers, the rapidly rising waters after every rain causing floods, the driving of logs was not possible until booms had been constructed. These were long timbers fastened together with chains and anchored to piers in the rivers. A boom formed a pocket into which the logs driven loosely down the river were floated and

held until needed by the mills. The boom at Williamsport on the Susquehanna River, erected in 1846, gave great impetus to the manufacture of lumber. At one time over thirty saw-mills were operated at Williamsport and in its vicinity. It became the great center in the East for the manufacture of lumber. The lumber industry also developed rapidly wherever booms were constructed.

When the timber became scarce in the lower parts of the rivers, the industry gradually moved farther up the streams into the interior. The coming of the railroads opened up vast stands of timber remote from the rivers. The increasing demand for lumber soon brought about a change in the methods of logging, steam logging largely taking the place of the earlier methods. The logs were often skidded out of the woods by steam skidders and loaded on cars by steam loaders, and taken to the mills over the railroads. The logging operations were no longer confined to the winter but continued throughout the year. The character of the men engaged in logging gradually changed with the method. There developed a class of men who were employed the year round. So great was the quantity of lumber that finally came to be manufactured that from 1860 to 1870 Pennsylvania stood first among the other lumber-producing states in the annual output. Pennsylvania also became known as the "tanbark state," owing to the large amounts of hemlock and oak bark that were shipped out. Large quantities of hemlock timber were sacrificed for the bark. The

trees were peeled and the logs left in the woods to rot or burn. Hemlock was considered an inferior tree.

Pennsylvania lumbermen became famous for the many methods of logging devised and put into operation on the steep mountain slopes. In no other region in the East was the harvesting of logs more difficult. Many of the men who became famous as loggers in the Appalachians and in the large timber of the Far West, obtained their knowledge of logging in Pennsylvania. It has often been said that Pennsylvania lumbermen taught the remainder of the country how to log timber.

The method of utilizing this great wealth of forests in Pennsylvania has not differed from that employed in other forested regions. A large part of the original forested area was cleared for farms. In the early days, because of lack of a market, especially for the hardwoods, the logs when cut were rolled into piles and burned. Unfortunately, large areas unsuited to growing agricultural crops were cleared as well as the fertile land and were later abandoned. Iron furnaces in the early days utilized great tracts of forests for making charcoal. Some of these tracts were cut over two and three times. Vast areas of forest land have been cut and the products used in the mines.

In cutting the forests for lumber, the methods so typical of this industry were employed. Everything merchantable was removed. Where fires did not follow the cuttings, as was usually the case in the early

days before steam logging was introduced, a new forest sprang up from the young trees and seedlings left after the logging. These stands of second-growth timber have now become of great value. Where fires were allowed to run year after year through the slashings after the lumber operations were over, the death of the forest was brought about by the destruction of the young trees. As a result, five million acres of land in Pennsylvania are now barren or poorly stocked that formerly produced magnificent forests. This barren and idle land is, however, potentially forest soil. It once was heavily timbered and a similar forest can be grown.

In 1850 Pennsylvania stood second among the states in lumber production and in 1860 first. As early as 1870, however, the stand of white pine, the most valuable species in the State, had diminished to such an extent that imports from Michigan began. The depletion of the white pine was followed by an increasing cut of hemlock and later of hardwoods, and the State reached its maximum lumber production of 2,440 million board feet in 1889. By 1900 Pennsylvania stood fourth in lumber production and in 1918 fell to the twentieth place. The annual cut in that year of 530 million board feet constitutes less than 2 per cent of the cut of the country. The annual lumber production was only 63 board feet per capita, which is about one-fifth the average per capita consumption for the United States.

About 1900 Pennsylvania changed from a lumber exporting to a lumber importing state. In 1918 the

State produced only 20 per cent of the lumber used within her borders. Eight years earlier there was a deficit of 62 per cent, and in 1900 her population was only 17 per cent short of her consumption. The following table shows the lumber production and lumber consumption for decades from 1880:

YEAR	LUMBER PRODUCTION IN BOARD FEET	PER CAPITA PRODUCTION (BOARD FEET)	LUMBER CONSUMPTION IN BOARD FEET
1880	1,733,844,000		1,567,538,000
1890	2,113,267,000	1890—420	1,992,787,000
1900	2,321,284,000	1900—387	2,791,837,000
1910	1,241,199,000	1910—162	3,242,342,000
1918	530,000,000	1918— 63	2,633,965,000

According to the report on Senate Resolution 311 by the United States Forest Service, the present forest area of Pennsylvania is estimated at approximately 13,000,000 acres, with a stand of eleven billion board feet of timber. Of this 70 per cent is hardwoods, chiefly oaks, chestnut and northern hardwoods, and 30 per cent softwoods, one-half being hemlock. In addition to the stand of material suitable for the manufacture of lumber, it is estimated that there are 380,000,000 cubic feet of wood suitable for railroad ties and mine props. The total stand, including fuel wood, is 5,200 million cubic feet.

Of the 28,160,000 acres of virgin forest that once covered the State, it is estimated that less than 50,000 remain uncut. The present forest of 13,000,000 acres covers about 45 per cent of the State. Of this forest

1,126,000 acres are in State forest, 4,043,000 in farm woodlots, and 8,000,000 are privately owned. There are about one and one-half acres of forest land per capita.

Only about 50 per cent of the eleven billion board feet of timber now standing in the State is suitable for manufacture either as lumber, pulpwood, ties, or props. It is estimated that at least half of the present stand is in farm woodlots.

Stumpage values have increased rapidly, the minimum and maximum per M. feet B.M. received for timber of the more important commercial species by decades from 1890 to 1919 being as follows:

YEAR	MINIMUM STUMPAGE VALUES	MAXIMUM STUMPAGE VALUES
1890	$0.50	$10.00
1900	1.00	20.00
1910	3.00	30.00
1919	10.00	75.00

The number of saw-mills operating in the State has decreased in about the same proportion as the annual cut of lumber. (See Appendix B.)

White pine and hemlock have been the two most important softwoods. The rapid decrease in the amount of lumber of these species cut in the State since 1907 is shown in the table on page 72.

In 1905 Pennsylvania stood fifth in the manufacture of pulpwood, producing 12.3 per cent of the total amount manufactured in the United States. In 1917 the State still occupied the fifth position, the

YEAR	ANNUAL CUT OF WHITE PINE IN BOARD FEET	ANNUAL CUT OF HEMLOCK IN BOARD FEET
1907	134,746,000	849,327,000
1908	89,547,000	561,246,000
1909	92,431,000	687,005,000
1916	31,732,000	243,810,000
1917	25,756,000	242,628,000
1918	24,615,000	200,573,000

amount of pulpwood manufactured being 12.9 per cent of the total for the country. (See Appendix C.)

Pennsylvania was one of the earliest states to recognize that it is the duty of a state to care for the forests for the benefit of future generations. Farseeing men, noting the rapidly disappearing timber and the destruction wrought by repeated fires to the future of the forest, saw the necessity of growing timber as a crop as is done in the older countries of Europe. They realized that the growing of timber cannot be left to nature, but requires the guiding hand of men trained in the principles of forestry. The Pennsylvania Forestry Association was established in 1889 and through its efforts a State Department of Forestry was established in 1895. J. T. Rothrock, who was largely responsible for the success of the movement, was made the first Commissioner of Forestry. He will always be remembered as the father of Pennsylvania forestry.

The State Department of Forestry began purchasing land at the headwaters of the large rivers in 1898. The total area of forests owned by the State in 1922 was 1,126,000 acres which have been

purchased at an average cost of $2.28 an acre. To administer and care for these forests, the State Forestry Department employs forty-three foresters and eighty-seven forest rangers. There are 2,488 forest fire wardens who watch for and fight forest fires throughout the State. The State maintains four forest nurseries with a capacity of five to eight million trees annually. A total of 34,216,727 trees have been planted on the State forests. These plantations cover an area of 22,410 acres. During the past twelve years private planters have received from the Department of Forestry 14,637,209 trees which have been planted on idle lands in the State and the demand for trees is increasing very rapidly.

The State Forestry Department maintains a Forestry School at Mont Alto, established in 1905 to supply foresters for the service of the State. A Forestry School is also located at The Pennsylvania State College.

The depletion of the timber supply in Pennsylvania has already progressed so far that by the end of the next decade all large logging operations will have ceased. Except for the virgin timber lying at the headwaters of the tributaries of the larger rivers and the mills it supplies, lumbering as a great industry in the State is about at an end. The great mills that formerly cut millions of feet of lumber every year have been moved to other regions or are rusting to the ground. Portable saw-mills have taken their place, cutting the timber that has grown since the early cuttings. Many towns that during the lumber

days were centers of activity have practically ceased to exist.

Pennsylvania uses annually about two and one-half billion board feet of lumber, of which amount the State produces only one-fifth and is growing only one-third. The State has sufficient forest land to supply the needs for wood products, provided the land is made to produce its maximum growth of timber. This is the forestry problem of Pennsylvania. Under her fixed and definite far-seeing forestry policy, the time is not far distant when the mountains of the State again will be covered with valuable stands of timber.

GAME AND FISH

The primeval forests of Pennsylvania teemed with game animals. Among these early forms that are now extinct in the State were the bison, moose, elk, timber wolf, and panther. In the early days no game laws were known, and large numbers of game animals were wantonly slaughtered. Early hunters are reported to have bagged as many as fifty deer in a few days. Poison, traps, and falls were used in capturing. Like the timber, the supply was believed inexhaustible.

Game was a very important source of food supply and much was utilized in this way, but enormous numbers were slaughtered for the fat, hides, and fur. As the population increased and the supply of game decreased, it became important that certain restric-

tions be placed on both the manner and the number of animals killed. Various game laws have been passed until today Pennsylvania possesses one of the best codes both as to conservation of game and protection of human life.

Had adequate laws been provided in the early days, there would still be roaming about the forests bison, moose, and elk. The beaver, once abundant, was early exterminated for its fur. Efforts, apparently successful, are being made to introduce elk and beaver to the forests by establishing colonies on the State lands.

The black bear is plentiful in some sections and sometimes weighs 300 pounds or more. Wild cats are common in certain localities. Deer are plentiful and are increasing, as the second growth forests are ideal for their propagation and protection. Porcupines, groundhogs, skunks, weasels, squirrels of three species, foxes and muskrats abound. In certain out-of-the-way sections, wild turkeys are found in goodly numbers, and numerous ruffed grouse are shot every year.

Pennsylvania now has one of the finest systems of game refuges and preserves in the United States. There were in 1921, eighty game protectors, twelve game preserves with a total area of 90,506 acres, and twenty game refuges with a total area of 73,860 acres.

LARGE GAME KILLED

	1907	*1915*	*1918*	*1919*	*1920*	*1921*	*1922*	*1924*
Bear	200	188	387	472	420	510	563	500
Deer	200	1,287	1,754	2,939	3,300	4,836	6,116	6,452

HUNTING LICENSES ISSUED

	1915	*1916*	*1917*	*1918*	*1919*
Resident	262,355	290,422	315,474	311,290	401,130
Non-resident	532	662	588	478	1,128
	1920	*1921*	*1922*	*1923*	
Resident	432,240	462,374	473,735	497,191	
Non-resident	1,725	1,763	2,126	2,328	

In 1921, $62,347.27 were expended for purposes of game stocking and bounties to the amount of $128,269.50. From 1915 to 1922 bounties were paid on 2,600 wild cats, 45,000 foxes, 260,000 weasels, amounting to $500,000. For a table of game killed in Pennsylvania, see Appendix D.

When Pennsylvania was first settled, its waters teemed with fishes. The State has no salt water front, consequently all its fishes are either fresh water fishes or those which come into fresh water from the ocean to spawn; as, for example, the shad, herring, white perch, and common sturgeon. The total species indigenous and introduced number 157. Fishes are classified into two groups: food or game fishes and worthless or undesirable species.

The food fishes are shad, white fish, herring, lake herring, cisco herring, alewife, sturgeon, and striped bass or rock fish. Game fishes include salmon, brook trout, and all the species belonging to the salmon or trout family; black bass, green or Oswego bass; crappie, grass or strawberry bass, white bass, rock bass, blue pike, pike-perch, wall-eyed pike, pike, pickerel, sunfish, and muscallonge. Other fishes found in the State are eels, catfish, suckers, carp, minnows, and darters.

The Pennsylvania shores of Lake Erie always have been a source of fish supply. Nets were not used in Lake Erie until 1830 or 1831, the hook and line method of catching fish having been employed exclusively before that time. During the fishing season of 1902, in favorable weather one boat caught daily six to eight tons of fish. The value of the catch of that year was $600,000. The tabulation in Appendix E of catches for Pennsylvania commercial fisheries of Lake Erie gives some idea of the value of this source of supply.

In the early days the rivers furnished large quantities of shad during the "run" of this species. In 1843 a pork barrel could not accommodate more than forty shad. In 1873, more than one hundred found commodious quarters therein. In 1873 the shad catches netted $81,000. In 1890 this value grew to over one-half million dollars. In 1892 the catch in Delaware River was valued at $650,000; in 1897 the value was $500,000 wholesale and $1,250,000 retail.

The brook trout is probably the typical fish of Pennsylvania. It occurs in the streams throughout the mountainous parts of the State. Many of these waters have become famous as trout streams. From a commercial standpoint brook trout are not of the greatest importance, but they have ever been prime favorites with the fish culturist and the angler. The game attributes of the fish are of such an order as to give it first place with most anglers. As a food it is considered a great delicacy.

In Pennsylvania, millions of trout are annually

propagated artificially and distributed in the various streams. In 1903, 6,500,000 trout fry were produced and distributed, in 1915, 2,505,000, and in 1921, 2,508,000. In 1915, 954,900,285 and in 1916, 687,257,950 fishes of all species were produced and distributed.

The early part of the nineteenth century marked the beginning of a very perceptible diminution in the fish life of the various waters in the State. This was caused by the erection of dams in the rivers, illegal methods of fishing, the use of deleterious substances, excessive fishing, and water or stream pollution. The fish basket and the set-net or fyke-net were the devices most responsible for the wanton destruction of the large quantities of fish in the large rivers.

The increase in population marked a similar increase in the growth of mills, factories, and other industrial establishments. These also contributed their share to the destruction of fish life. Sawdust, culm, tannic acid, dyes, waste liquors, and other similar substances caused a water pollution against which the authorities are still battling and striving, with many of the manufacturers, to overcome.

MINES

Pennsylvania holds foremost place in the Union in mining operations. It produces about 22 per cent of the mineral value of the country and over three times that of any other state. It is first in the production of coal, cement materials, stone, gravel, and

glass sand and second in clay products and natural gas. It also produces great quantities of petroleum, and considerable iron ore and graphite.

In 1913, the last year of normal conditions before the Great War, Pennsylvania mined 85 per cent as much coal as Great Britain, the second greatest coal producer of the world, and it supplies over 40 per cent of the coal of this country, including practically all the anthracite. According to *Mineral Industry* for 1918, the value at the mines of the coal alone from Pennsylvania, in 1917, was $704,919,531, a value which is probably close to that of all agricultural products of the State. To this figure must be added at least $150,000,000 for other raw mineral products, bringing the total for that year up to over $850,000,000. No definite figures have yet been published for later years.

In precious metals Pennsylvania is deficient as it produces almost no gold or silver and no platinum. The State has very little copper, lead, or zinc and is without tin, mercury, sulfur, cadmium, antimony, arsenic, bismuth, selenium, or tungsten. No production of phosphate or potash is reported, although numerous rumors are current of finding these materials. From the agricultural standpoint it is much to be regretted that these substances do not occur in the State. Chromite, the ore of chromium, asbestos, and nickel have been mined intermittently.

The following mineral and rock substances occur in Pennsylvania and are being extracted or have been extracted in the past: Coal, clay, cement ma-

terials, petroleum, natural gas, iron ore, sand and gravel, limestone, stone other than limestone, chromite, pyrite, graphite, feldspar, slate, lead and zinc, copper, nickel, gold and silver, manganese, salt, peat, mineral waters.

Although anthracite or "hard coal" is so important in the United States, it is confined to a very small area and is nearly all found in the eastern part of Pennsylvania (Fig. 11). The anthracite field covers a total of about 3300 square miles, of which only 480, or approximately one-seventh, are underlaid by workable coal. The coal occurs in the following counties: Susquehanna, Sullivan, Wayne, Lackawanna, Luzerne, Carbon, Columbia, Northumberland, Schuylkill, and Dauphin. The coal in Sullivan County is not real anthracite for the most part but it passes under the name of semi-anthracite, a variety of coal lying between bituminous and anthracite. The best known centers in the anthracite field are Scranton, Wilkes-Barre, Hazleton, Pottsville, Nanticoke, and Shamokin. The cities, towns and villages are usually located in the valleys in which the hard coal occurs and the whole region is remarkable for its large foreign population. This has profoundly affected the rural life of that part of the country. In 1918 nearly 148,000 men were employed in mining anthracite and of these only 43 per cent, according to E. E. Bach, are English-speaking. Of the total men employed in mining in the country 70 per cent are foreign born. Pennsylvania has workmen comprising thirty-five different

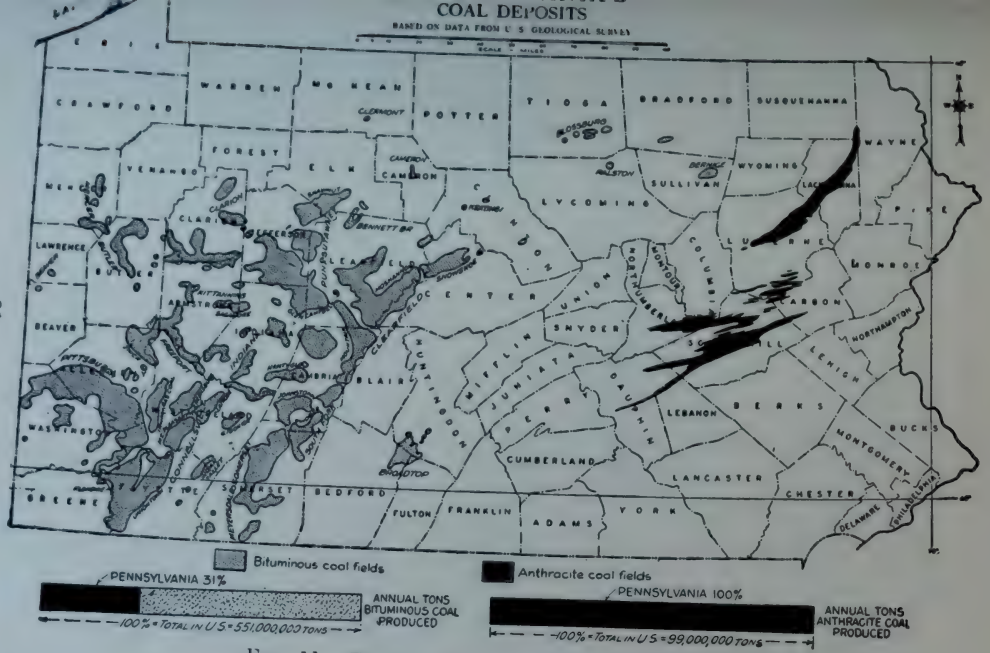

FIG. 11. The coal deposits of Pennsylvania.

nationalities and languages engaged in her coal industry, and the second largest foreign-born population of the Union. It is said that before the war 22 per cent of all immigration to the country came to this State. Many of the immigrants are excellent persons but parts of the anthracite field have been known for their low social standards. When the

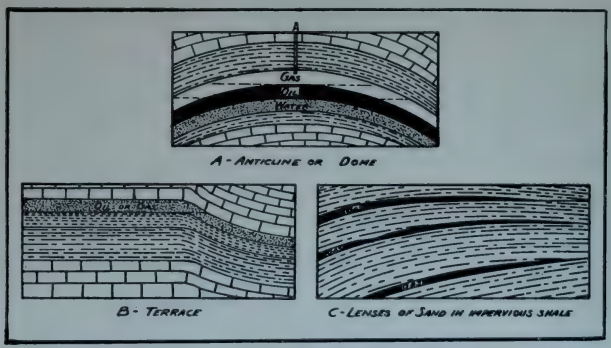

Fig. 12. Diagrams of some of the structural conditions under which ore and gas may occur.

undesirable type of immigrant landing on the eastern shore wishes to enter coal mining, he is likely to drift into the nearest coal field and many have found their way into eastern Pennsylvania.

The agricultural and coal mining sections of eastern Pennsylvania are much more distinctly separated than they are in many parts of western Pennsylvania and in some of the central states. Since anthracite only occurs in those areas of the earth's crust which have undergone serious compression,

the rocks of the anthracite field have for the most part suffered great folding and the strata are steeply tilted (Fig. 12). This condition and the fact that the coal measures carry heavy sandstone and conglomerate formations have given rise to a series of rugged hills separated by valleys under which and along the flanks of which the coal usually lies. A great part of this region is so rough and rocky that it is utterly useless for farming purposes, and the only place where farms can prosper is in the valleys. Some of the land in these alluvial valleys is quite suitable for farming purposes and there the mining operations affect agricultural pursuits because some land is covered by culm piles, waste rock, or the wash from breakers, and much of it is injured by caving of the surface over the old workings, for it is only under cities that special pains are taken to prevent caving. In the central and southern parts of the field, there is considerable stripping of the thick seams; this operation opens up tremendous pits and produces great rock dumps on the surface.

The streams in the hard coal region are, as a rule, blackened by coal sediment and the dredging of these has become quite an extensive operation. It is carried on along the Susquehanna and streams entering it from the east. In 1918 about 125,000 tons of coal were raised from the stream bottoms. The amount increased 164 per cent, according to *Mineral Industry*, over that dredged in 1917. In recent years much material in the culm banks has been made use of by briquetting. In the course of time many of

these huge piles which have not been gutted by fire will be ground up and burned as briquettes or in some form of dust.

Since the annual production of Pennsylvanian anthracite is around 90,000,000 tons and the resources of the field are estimated at about 16,000,000,000 tons, mining operations should flourish for very many years to come.

The bituminous field of Pennsylvania is estimated to cover about 12,000 square miles and the following counties contain workable coal seams: Greene, Washington, Westmoreland, Fayette, Somerset, Bedford, Huntingdon, Blair, Cambria, Indiana, Armstrong, Allegheny, Beaver, Butler, Lawrence, Mercer, Clarion, Jefferson, Elk, Cameron, Clearfield, Center, Clinton, Lycoming, Tioga, and Bradford. As will be observed from Fig. 11, all the bituminous coal lies west or northwest of the Allegheny front except a small area making up the Broadtop field in Huntingdon and Bedford counties.

In 1917 the production of the State was 172,448,142 short tons valued at $421,268,808 at the mines and in 1918, according to *Mineral Industry*, the output was about 10,000,000 tons more. The number of employees who produced this tonnage is placed at 172,600. The conditions under which bituminous and anthracite coal occur are entirely different. The former exists mostly in flat-lying seams outcropping on the sides of hills, where it has been exposed to view by erosion of streams, which have cut out gullies in the strata. The latter occurs,

on the other hand, in highly folded areas and mostly in the valleys where erosion has not reached it. The mining operations differ greatly in the two fields. In the bituminous field the coal is much nearer the surface, as a rule, and where there are shafts they are not so deep as many of those in the anthracite field. Many of the bituminous coal mines are very large and are owned by large corporations, but there is a much larger percentage of small drift mines than in the anthracite region where most of the land is controlled by large corporations. Many farmers and villagers have their own bituminous "wagon" mines and can dig their own coal supplies if necessary.

In the bituminous field the topography is very rough where the streams issue from the interior through the Allegheny escarpment into the valleys along its face, and the only place where farms could exist is along the stream valleys and such farms must be small and unimportant. They are little affected by mining operations. On the Allegheny Plateau, which is the flatter area above the escarpment, the agriculturalists and miners come more closely in contact with each other as large sections of the coal lands are farmed, although they are not regarded as the best type of farm land owing to the stony, sandy, and comparatively unfertile soil. These lands are affected by caving of the surface where the coal seams are at shallow depths and in limited areas rock dumps destroy farming land. This destruction is not nearly so great as in the anthracite region

where so much of the coal is washed in breakers. With the increasing tendency to wash bituminous coal, the effects on farming lands in valleys will be felt more than it has been in the past. At present not much coal sediment is carried by most of the streams in the bituminous field, but some are heavily charged with "sulfur," which has a deleterious effect on the water for communities through which these streams flow.

Considerable coke is produced in Pennsylvania. In 1916, according to *Mineral Resources*, 31,279,695 tons worth $84,710,305 were produced, which is more than seven times as much as that from any other state. This was made in both beehive and by-product ovens, the proportions being about 6.6 : 1. The proportion of by-product coke to that of beehive is increasing rapidly. This is a favorable sign because of the tremendous waste entailed in the use of the beehive ovens which discharge all the gases, tars, and other materials, volatile at high temperature, into the atmosphere. The smoke makes life disagreeable for the inhabitants who must live in the neighborhood and it is injurious to crops when concentrated. Most of the coke is made in the Connellsville region but there are also many ovens in the central-western part of the State.

As previously stated, Pennsylvania is the second largest producer of clay and clay products in the country. It is surpassed by Ohio in total value and quantity, but in some important types of clay products the State far exceeds all others in the

Union. In 1916, according to *Mineral Resources,* the value of clay products was $32,110,690 and Pennsylvania marketed half of the fire brick in the United States. Common brick is the next item of importance in the clay products and fortunately for the rural communities clay for this commodity is abundant throughout most counties of the State.

Most of the clays, and especially the fire clays, are closely associated with the coal deposits and the distribution of the two rocks is much the same. In many cases clay and coal are extracted from the same mine, and in so far as the rural life of the State is affected the mining of clay is much the same as the mining of coal.

There are some white clays in the State which are used in the manufacture of porcelain, white ware, paper, and other products. These clays may occur in farming communities in the southeastern section where the feldspar in pegmatite dikes has decomposed and in central Pennsylvania where white clays are found most abundantly in the more sandy areas. Since they are mined chiefly in the more rocky and sandy sections, they do not affect the agricultural interests very greatly beyond giving employment to certain classes of labor.

In the earlier years of the last century considerable natural cement rock was quarried in the United States, and the amount increased gradually to over 8,000,000 barrels a year at the end of the century when it began to decline and now less than a million

barrels a year are produced in this country. This natural cement is a siliceous and aluminous limestone which is burned to a point between decarbonation (liberation of CO_2) and clinkering, after which it will set with water. It sets more quickly than Portland cement but is not so strong. At the present time only one plant in Pennsylvania, at Siegfried, produces natural cement.

No Puzzolan cement, made either from furnace slag or volcanic ash, is manufactured in Pennsylvania.

Portland cement began to be extensively used in this country about the beginning of the century and its production increased by leaps and bounds with Pennsylvania leading all other states in the Union. This has the advantage over natural cements in being stronger and, since its composition is readily controlled, a uniform product is assured. There are plants at New Castle, Wampum and York, besides the great group in the Lehigh district where most of the cement is manufactured. The production for Pennsylvania runs about 28,000,000 barrels per annum. In 1918 the average factory price a barrel was $1.52, an increase of 24.5 per cent over 1917.

The Lehigh district is one of the most remarkable in the world for Portland cement rock. The formation known as the Trenton limestone is used for its manufacture and fortunately nature has mixed with the limestone just enough clayey material to make a mixture containing about 75 per cent calcium carbonate ($CaCO_3$) and less than 5 per cent mag-

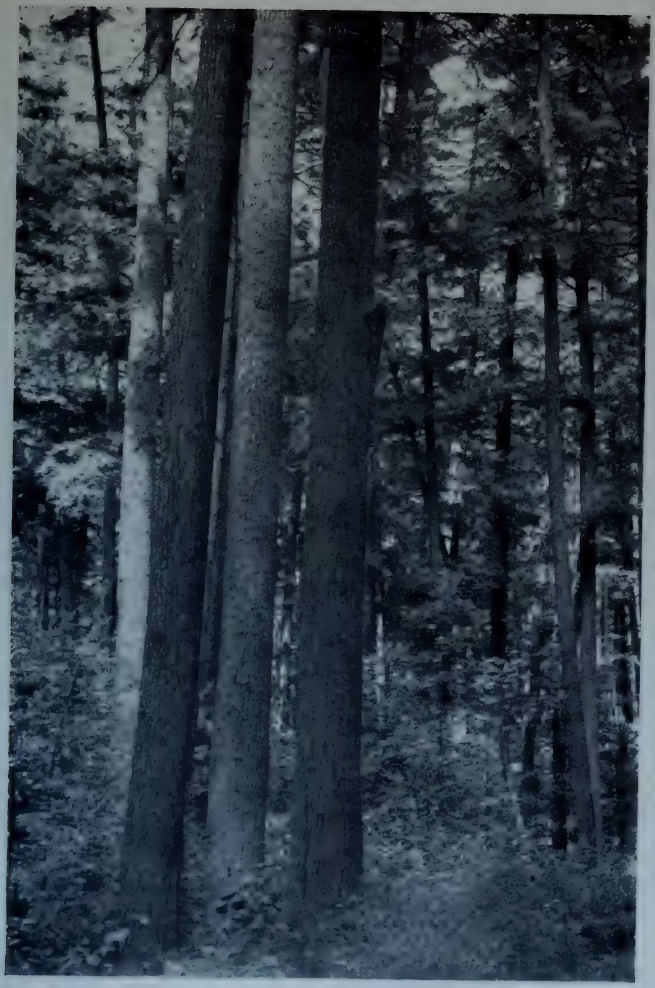

Plate III. Virgin timber of this character at one time covered practically the entire State.

nesium oxide (MgO). This mixture, when clinkered at high temperature and ground, makes the cement. In many localities it is necessary to mix shale or clay with limestone to furnish the proper ingredients, but much of the Lehigh rock already contains the proper proportions of these substances.

The manufacture of cement has a bearing on the rural life of the community in that the rock quarried, being limestone, is usually dug from fertile areas. A certain amount of potash may be saved from the cement dust, as has been shown by experiments of recent years, and this will be an asset to agricultural operations. The possibilities for the development of the cement industry in Pennsylvania seem to be very great as the demand increases.

Petroleum was discovered in the United States in Venango County in 1859 and Pennsylvania was for a long time the most important producer in the Union. It has, however, dropped down to such an extent that in 1916 the output was only 24 per cent of that in 1891. On January 1, 1916, there were 58,443 productive wells in Pennsylvania and 1,103,335 acres of land controlled by oil companies or individuals, of which 300,762 acres were held in fee and 802,573 were leased. The oil lands lie in Allegheny, Armstrong, Beaver, Butler, Clarion, Crawford, Elk, Forest, Greene, Jefferson, Lawrence, McKean, Mercer, Potter, Tioga, Venango, Warren, and Washington counties.

The formations from which the oil is derived extend from the Chemung of the Devonian up to and

including the Conemaugh of the coal measures. The question is often asked whether oil and gas should not be found in the eastern and south-central part of the State. The chances of discovering these substances there are small, because the rocks are older than those in which all the oil and gas so far found in the State occur and as a rule they have suffered too much squeezing to permit these substances to be retained in them. It is true, of course, that oil has been found as low as the Trenton limestones of the Ordovician system in Indiana and gas as low as the Potsdam of the Upper Cambrian in New York, but these formations have not suffered the compression undergone by rocks of this age in Pennsylvania.

On account of the high quality of the Pennsylvania oil, which is almost free from sulfur and has a paraffin instead of an asphalt base, so characteristic of most western oil, the price of crude oil has usually run a little higher than that from any other State.

The petroleum industry has exerted an important influence on the rural life of the counties mentioned above, in that farmers have made large sums out of leasing their lands and many have grown rich over night.

Although long the leader, Pennsylvania is now second in the country in the production of natural gas, with West Virginia heading the list. There were, according to figures published by the United States Geological Survey in 1916, 2,398,118 acres of land controlled by gas producers in this State, of

which 179,753 acres are held in fee, 1,837,648 leased, and 380,717 of which the gas rights are held. There were 13,917 productive wells at the close of that year.

Natural gas is closely associated with petroleum, although it is sometimes found without it. The counties in which it occurs in this State are the same as those mentioned under petroleum with the addition of Erie, Fayette, Cambria, Indiana, and

FIG. 13. Diagram illustrating the relation of iron ore to the limestone at Cornwall, Pennsylvania.

Westmoreland. The natural gas supply of Pennsylvania is being rapidly depleted. This will result in serious inconvenience in the near future to many rural communities which have been dependent on gas for heating and lighting, especially the former, because in many houses no provision has been made for installing coal-fired heating systems, some of them being without chimneys.

As in the case of the development of the petroleum industry, natural gas has enriched many persons in rural communities but probably many more have

become impoverished through foolish investments, as natural gas is even a more elusive mineral product than petroleum.

Gas is found in the Devonian formations in northwestern Pennsylvania, the Devonian and Mississippian in the western part of the State and in the Devonian and lower Pennsylvanian in the

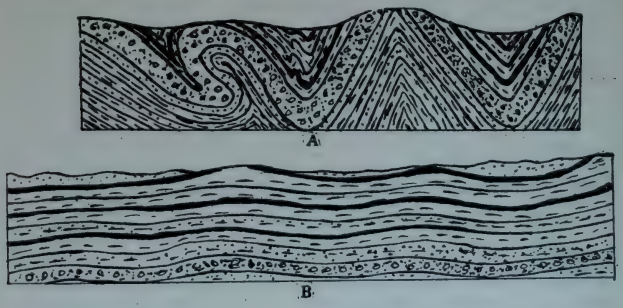

FIG. 14. Diagrams illustrating the relative structural conditions in the anthracite and bituminous coal fields: A, anthracite; B, bituminous.

southwestern section, and, like petroleum, it is definitely associated with anticlines or other geological structures (Fig. 13).

Pennsylvania is not now as prominent a producer of iron ore as during the last century, before the great deposits of the Lake Superior region and of Alabama were discovered. The annual output now runs about a half-million tons and consists chiefly of magnetite (Fe_3O_4) from the large mine at Cornwall, Lebanon County. This deposit (Fig. 14) has been worked

from very early days and it has probably produced to the present time over 30,000,000 tons of ore. The ore is associated with a great dike and sill of diabase, usually called "trap" and is found replacing limestone along the contact of the trap and limestone. The mine worked so far is an open pit of great size cut into three knobs known as Big Hill, Middle Hill, and Grassy Hill, but, owing to the tremendous amount of stripping of overlying limestone, red sandstone, and conglomerate becoming necessary, underground work will have to be adopted in the future. The ore is mostly low grade but it can be mined in great quantities with steam shovels, so that the cost of mining is low. This mine occurs in the midst of a fine farming region, but it affects the farm land very little because it is situated along a very rocky ridge unsuited for agriculture. It has always exerted some influence on that neighborhood because farm hands have worked in the mines during slack seasons on the farms. A number of other deposits of this type but much smaller occur in the adjacent counties to the east of Lebanon.

The iron ore deposits which have had most direct influence on the rural communities of the State are the brown iron ore, or limonite, deposits (Fig. 15) which were formerly so extensively worked but which are now mostly abandoned. These deposits occur in limestone or sandstone and they may be in the midst of a good agricultural district. They are of the residual type and the iron oxide is found as nodules in clay, sand, or fragments of chert. It had to be

washed before shipping to the furnace and this was done in the old-fashioned log washers. These mines and the charcoal furnace which existed contemporaneously with them formerly furnished much employment for the farmers during the slack months. The deposits are very irregular in form, indefinite in extent, and most of them small in size. They have

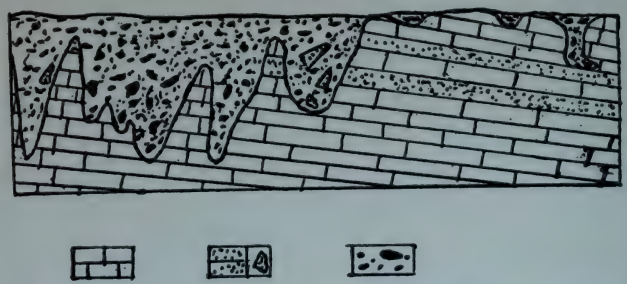

FIG. 15. Diagram showing how limonite occurs in the limestone valley iron deposits of Pennsylvania. The rectangular areas indicate limestone, the small black dots indicate sandstone, while the larger black areas show limonite in clay sand and chert.

been worked almost altogether as open pits. A few, however, have produced a large tonnage for deposits of this type. One of the best known of these is the Scotia Mine, at Benore, in Center County, which has produced over a million and a half tons of ore. There seems to be little doubt that some of these deposits will again furnish ore in the future when the larger deposits are more nearly exhausted.

Some of the Clinton hematite, commonly known

as "fossil," "pea," "flaxseed," and oölitic ore, has been mined in the past but not on a very extensive scale in this State. This type exists in a formation of Silurian age underlain by resistant sandstone, which is a mountain former and does not affect the farming communities to any extent as it usually occurs on the flanks of mountains where land cannot be tilled.

For glass-making, sand must be clean and consist of over 98 per cent silica. For optical glass it must be practically free from all iron oxide or other coloring matter. The grains should be uniform in size and readily separate from one another in crushing, but they may be either rounded or angular. Pennsylvania is the largest producer of this product and the great bulk of the sand comes from the formation known as the Oriskany sandstone. This sandstone crumbles easily, leaving the sand grains separate, Other formations, like the Pottsville and Burgoon sandstones, may be used. The sand is washed before fusing.

Molding sand is fine and uniformly grained, has a natural bond, fuses at a fairly high temperature, and permits the gas to escape from the castings. Before the War molding sand for fine work, like brass and bronze molding, was imported from France but satisfactory material has been found in Ohio and New York. The leading state for the production of molding sand is Ohio, while Pennsylvania comes second.

Building sand is an important factor in rural

communities, but it is so common throughout Pennsylvania that it is familiar to all and almost anyone can obtain local supplies.

Pennsylvania is the largest producer of sand employed in grinding and polishing, also of fire sand. Grinding and polishing sand is used in sand blasts, sand paper, and for similar purposes. Fire or furnace sand is a very refractory soil called ganister, consisting almost entirely of silica, and is used in lining furnaces in which a very high temperature is required. Silica brick is made from a pure silica sand but chiefly from crushed sandstone. This sandstone is very commonly spoken of as ganister rock. It must be low in iron or other impurities which aid fusion and when the sandstone is crushed the grains should break rather than separate from one another as they do in glass-sand rock.

The total value of sand and gravel produced in Pennsylvania in a year amounts to over $4,000,000. Gravel, like sand, is abundant in the State and is an important factor in rural communities, especially in road building. It is found most abundantly in the glaciated districts of the northern and eastern sections and along streams. Over 2,000,000 tons are produced per annum.

On account of the great importance of limestone in most rural communities, it will be discussed separately from the other types of stone. It is used for building, paving, flagging, rip rap, rubble, railroad ballast, road metal, concrete, flux, and the manufacture of lime. The value of the product runs

from $6,000,000 to over $8,000,000 a year in Pennsylvania, which state leads in quarrying of the rock. This does not include limestone for cement nor that used in many small lime kilns run by farmers. About seven-eighths of the value is for furnace flux and Pennsylvania produces from three to four times as much limestone for this purpose as any other state in the Union. Ohio comes second.

The second most extensive use for limestone is for concrete and the third for road material. Great quantities are used in the manufacture of lime which is employed in agriculture, in glass-making, in sugar refineries, chemical works, tanneries, paper-mills, in building and for minor purposes. According to *Mineral Resources*, Pennsylvania had approximately ten times as many lime plants in operation in 1916 as any other state. The quantity of lime produced was almost a million short tons and the value $3,857,553.

Most counties in the State contain at least some limestone which can be used for ordinary purposes but which is not of the greatest purity. In twelve counties, however, there is no record of production nor occurrence of limestone of much value. These counties are Cambria, Cameron, Elk, Erie, Forest, McKean, Potter, Sullivan, Tioga, Warren, Wayne, and Wyoming. Among those producing limestone some have a very limited amount. Such, for example, are Beaver, Bradford, Clearfield, Crawford, Fulton, Greene, Indiana, Lackawanna, Luzerne, Mercer, Susquehanna, and Venango. The most im-

portant limestone counties lie southeast and east of the Allegheny escarpment. This is due to the fact that in these counties the great areas of Cambrian, Ordovician, Silurian, and Lower Devonian limestones are brought to the surface through folding and erosion, while in the other counties the rocks are Upper Devonian, Carboniferous, and Permian in age and they consist chiefly of sandstone and shales, the typical associates of coal deposits. The later geological systems represented in Pennsylvania have a much greater proportion of mechanical sediments than the earlier Paleozoic systems in which calcium carbonate ($CaCO_3$) was laid down in such great quantities, in clear seas. In these older formations dolomite, the calcium magnesium carbonate ($CaCO_3.MgCO_3$), is much more abundant in proportion to the limestone than in the later formations and while it may be used when pure for practically all the purposes for which limestone is employed it is, as a rule, more siliceous or more argillaceous than the limestone. Since it is a replacement of calcium carbonate on the sea bottom or in the rocks above sea level, its impurity frequently may be connected with the replacement process, since the presence of impurities may aid replacement or this process may also be accompanied by replacement with silica. During the change from limestone to dolomite, a shrinkage of 12 to 14 per cent occurs, and although dolomites do not seem to be appreciably more porous than limestones, it seems probable that some silica and additional magnesium carbonate

may fill up this extra space. Silica is objectionable in producing clinkers and unburned lumps. There is considerable limestone [1] in Pennsylvania of exceptional purity and its quarrying is sure to be an operation of very great importance in the future.

Pennsylvania produces about one-half million dollars worth of granite each year. This rock is quarried only in the southeastern part of the State.

The value of trap rock or diabase quarried amounts to a little over one million dollars a year. This dark igneous rock is found as large dikes and in other masses in the southeastern part of the State, extending from Adams County eastward through Lancaster, Lebanon, and Berks. It is tough and resistant and very valuable for ballast, paving, road metal, concrete, and similar uses. Some quarrymen erroneously call certain tough sandstones in the central part of the State "trap."

Sandstone is quarried in large amounts for glass-sand, ganister and silica brick, polishing, and building. Various other uses of sandstone have already been mentioned. A considerable amount of Triassic red sandstone known as the Hummelstown brownstone is quarried near Hummelstown, Dauphin County, for building. This stone is used in Lebanon and neighboring counties for farm structures and for trimming buildings all over the State.

[1] For a description of limestones, see a paper by William Frear and E. S. Erb on "The Lime Resources of Pennsylvania" in the Annual Rept. Penn. State Coll., 1911-12, pp. 272-440.

A variety of feldspathic sandstone, known as "bluestone," has been quarried to a considerable extent in the northeastern part of the State, but its production is declining rather rapidly.

A small amount of marble is produced from Chester, Montgomery, and Northampton counties where limestones have been sufficiently changed by heat and pressure to produce this valuable metamorphic rock.

The ore of chromium has been mined on a small scale from time to time in Chester and Delaware counties. The ore occurs as very irregular bodies in masses of a dark basic rock known as peridotite. Much larger deposits elsewhere and the exhaustion of the deposits in Pennsylvania have caused the abandoning of the mines.

Pyrite, or iron pyrites (FeS_2), is employed in large quantities for the manufacturing of sulfuric acid. It is a very common mineral but no production is reported from Pennsylvania except a small amount obtained as "sulfur balls" or "coal brasses" from the coal mines in the bituminous field.

For many years graphite has been produced in Pennsylvania. It occurs in gneisses which are squeezed sedimentary rocks found in southeastern Pennsylvania. In 1918, 1,016,900 pounds, worth $112,059, were produced from mines at Chester Springs, Byers, and Pikeland in Chester County. The mines in some cases are on good agricultural lands and they have damaged farms by open pits, rock dumps, or caves. Other mines are on rocky

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areas unfit for farming purposes. The graphite rock is milled in the vicinity of the mines and the mineral separated by a flotation process.

The production of feldspar amounts to about 6,000 tons a year and it is worth in crude form about $4.00 a long ton. It is obtained from pegmatite dikes and is only mined in the southeastern corner of the State. It is used chiefly for pottery, enamel ware, and glass. Poultrymen sometimes feed it as grit.

Pennsylvania far exceeds all other states in the production of slate and the annual output is valued at over $3,000,000. It produces over 60 per cent of the roofing slate of the country. Of the slate produced in the State about four-fifths comes from Northampton County and practically all the remainder from Lehigh County. Lancaster and York produce a little. This rock issues almost entirely from the Ordovician system and from the formation which commonly goes under the name of the Hudson River slate, a mud rock which has been so highly squeezed that it possesses a well-developed cleavage. Some of the numerous quarries are in good farming communities and naturally they tend to destroy the agricultural operations by open pits, caving, and rock dumps. Operations are carried on both in open cuts and underground.

No production of lead or zinc is reported for Pennsylvania in recent years. Many prospects are scattered widely over the State but none has developed into important producing operations. The sul-

fides of these metals, as galena (PbS) and zinc blende (ZnS), are often found, especially in limestone areas and some veins occur in the gneisses and schists of Chester and adjacent counties, but the ores are only present in limited amounts. A group of mines near Friedensville and about four miles from Bethlehem produced considerable zinc ore between 1853 and 1876, but they are not now worked. The ores there were calamine, the hydrous zinc silicate, blende, the zinc sulfide, and a little greenockite, cadmium sulfide. Much difficulty was encountered with water in some of the mines. The ore occurs in shattered limestone in a zone upwards of a mile in length.

Copper has been mined to some extent in the past at the French Creek Mines, Chester County, and at the Gap Mine in Lancaster County. The only place in the State where copper is now being produced is at Cornwall where it is obtained as a sulfide concentrate from the iron ore. From this source as much as 625,000 pounds have been obtained in a year.

Pennsylvania was at one time the most important producer of nickel on the continent. Ore was mined at Gap, in Lancaster County, for a number of years during the past century, 1852 to sometime in the eighties, but the mine became nearly worked out and tremendous deposits of nickel ore were discovered in 1885 near Sudbury, Ontario, Canada, making all competition in mining of this metal impossible. It is claimed that the Gap mine was discovered about 1718 and it was worked for copper before 1744. It

was not until about 1852 that nickel was discovered. This mine is situated in the midst of a farming district and the remains of the old smelter are located a short distance from it.

Gold and silver are only obtained in Pennsylvania in very small quantities and in association with other metals. A very little gold is reported as being saved in the refining of the sulfide concentrates from the Cornwall iron mine. Any silver known to occur in the State is associated with lead sulfide in small amounts and of no economic importance.

Small quantities of manganese ore have been found in the State in the form of the black hydrous oxides, but very little has been mined as most of it is too low grade. In 1916 one operation produced about 450 long tons and during the War an effort was made to develop all available deposits, but not much has resulted from attempts to produce this metal in Pennsylvania.

Salt has been obtained from wells but no figures on production are available and the amount is small. Salt comes from the Carboniferous rocks in the vicinity of Pittsburgh.

Peat is rare in most parts of Pennsylvania and a small production is reported from Columbia County. It occurs near Espy.

Pennsylvania produces annually between a million and a half and a little over two million gallons of mineral waters from forty to fifty springs at a price averaging about eight and one-half cents a gallon. These springs are not confined to any particular

county but are rather widely distributed over the State.

From this brief discussion of mining operations it will be seen that Pennsylvania is unusually rich in most of those raw mineral substances necessary for great industries. It has the coal and coke, the limestone and refractories necessary for the operation of great steel plants and, while the iron supplies are inadequate, the State is so favorably situated with respect to the large deposits of the Lake Superior region and Cuba that the deficiency in this commodity is scarcely realized. Coal will continue for generations to be the greatest asset and with the growing improvement in the conditions of living and working in the coal mining communities, a great change will come over the rural life of parts of the State.

CHAPTER IV

HISTORICAL SETTING OF PENNSYLVANIA

The history of Pennsylvania affords ample justification for the name, Keystone State. It was one of the largest of the original thirteen colonies. Its natural resources of lumber, iron, coal, petroleum, and gas, the fertility of its soil, an abundance of water, and the spirit of enterprise and thrift exhibited by its inhabitants, have made Pennsylvania a leader among the American commonwealths.

The first settlement by Europeans in what is now Pennsylvania was made by the Dutch in 1631 near the present town of Lewes. Within a few months, however, this little colony was destroyed by the Indians. During the next fifty years the Dutch, Swedes, and English respectively made attempts to secure possession of the land west of the Delaware. Finally in 1681, William Penn, a Quaker, obtained from the English King, Charles II, a grant of land west of the Delaware River beginning twelve miles north of New Castle, and extending north to the forty-third parallel of north latitude, and westward over five degrees of longitude. It was Penn's purpose to establish a settlement in the new territory in

order to afford his co-religionists an asylum from the bitter persecutions to which they were subjected in Europe. On August 3, 1681, a council of nine persons was assembled at the old Swedish settlement of Upland, where the government of the new province was begun. In the following year the deputy governor, Markham, laid out at the confluence of the Delaware and the Schuylkill rivers a city which Penn, who had remained in England, called Philadelphia. In the summer of the same year Penn set sail for the new colony, where he arrived October 28.

One of Penn's first acts was to convoke an assembly at Upland, now called Chester, where a code of laws was adopted which offered an opportunity to establish an unusually cosmopolitan province. These laws provided that no one acknowledging Almighty God should "in any wise be molested or prejudiced for his or her conscientious persuasion or practice" or be "compelled to frequent any religious worship." Thus was Pennsylvania made a refuge for the oppressed nationalities of all Europe.

If it is true that the fusion of various nationalities is conducive to the evolution of a vigorous and enterprising people, colonial Pennsylvania was particularly fortunate. The religious freedom granted to the inhabitants of the colony drew not only the Dutch, Swedes, and English, but also many Welsh, Scotch-Irish, and Germans. Most of the English and Welsh were Quakers. For a long time they were the most influential of the colonists. On account of their ideas of nonresistance, they

formed the peaceful conservative element of the population. Also, since they were the first arrivals, they settled mostly in and near Philadelphia, including the county of Chester and the southern part of Bucks County. Twenty-three shiploads arrived before the close of 1682.

Within a year after the English Quakers had begun to arrive in large numbers, the second tide of immigration started. On October 6, 1683, a shipload of German Quakers, Mennonites, and Dunkers landed at Philadelphia. These devout men and women formed the vanguard of thousands of others who desired to found homes in a new land dedicated to peace. Indeed so important was this source of immigration that at the outbreak of the Revolutionary War at least one hundred thousand, or 33 per cent of the total population of the Province, were Germans.

Almost all the new arrivals were seeking a refuge from the persecution which they had endured in the Old World. The Mennonites and Dunkers, who had practically the same religious beliefs as the Quakers, found the colony a peculiarly congenial home. The Lutherans and Reformed, who began to arrive in the province about 1710, left their old homes on account of devastating wars and the oppression by the tyrannical rulers of the petty German states.

The early German immigrants settled at Germantown only a few miles from Philadelphia, but the later arrivals penetrated into the interior and

eagerly sought out the fertile farm lands of the district that extends in a huge semicircle from the Delaware River to the Maryland border, comprising the counties of York, Lancaster, Lebanon, Berks and Lehigh, and parts of Dauphin, Schuylkill, Montgomery, Bucks, and Northampton counties.

From a political point of view, the influence of the Germans in the colonial history of Pennsylvania was insignificant in comparison with their numbers. Although the Mennonites and Dunkers always gave their moral support to the legislative measures advocated by the Quakers, their religious tenets prevented them from taking an active interest in politics. Even the Lutherans and Reformed, who were not restrained from participation in public affairs by religious scruples, were not active politically. Their language, to which they clung so tenaciously, was a difficult barrier to political preferment. Their forefathers in Germany had lived for centuries without a voice in the government; consequently they had no traditions of self-government. Under these circumstances it would have been strange if they had immediately displayed either political interest or wisdom.

On the other hand, the Germans were probably the best farmers of the colonial period and were exceedingly thrifty. The reason for this preëminence is to be found in the conditions in their ancestral home. Most of them came from the Palatinate, in the valley of the Rhine River, which has been called the garden spot of Europe. How-

ever, it was also the battleground of the wars between the Holy Roman Empire and France. Fortunate indeed was the peasant whose humble dwelling escaped for more than twenty-five or thirty years the repeated ravages of the pillagers. Under such conditions peasants could earn a livelihood only by the most careful attention to their crops and by extreme economy. When they emigrated to Pennsylvania, these habits had become second nature to them. Their pre-revolutionary newspapers as well as their later publications contain many articles on improved farming methods. They made Pennsylvania the granary of the American army during the War for Independence.

The third great nationality which was destined to leave permanent impress on the inhabitants of Pennsylvania was the Scotch-Irish. The vanguard of these sturdy people probably arrived about the year 1710. The newcomers first settled in what is now the southern part of Lancaster County. Afterwards they pushed west into the Cumberland Valley and gradually settled the southern tier of counties, always being the pioneers in the new regions and always bearing the brunt of the Indian warfare. Often they cleared good farming land and erected dwellings, only to sell their holdings to the plodding Germans who followed in their wake. There were at least two causes for this incessant migration. In the first place the Scotch-Irish character rebelled against the monotony of farm life; and secondly as farmers they were utterly unable to

compete successfully with the Germans. Their importance in the settling of Pennsylvania lies, therefore, in fields entirely different from that of agriculture. They were not only frontiersmen and fierce Indian fighters, but also inveterate haters of England and things English. Just as the characteristics of the Germans can best be appreciated by a knowledge of the history of their European ancestors, so also the significance to Pennsylvania of the Scotch-Irish can better be understood if something is known about their eventful past in Scotland and Ireland.

The Scotch-Irish were descendants of a proud hardy race that had always refused to bow to a foreign ruler. In the sixteenth century they were attracted to the faith of John Calvin by that stern reformer, John Knox. Thus they became Presbyterians, while the English for the most part remained Episcopalians. After James VI of Scotland became James I of England in 1603, large numbers of these Scotch Presbyterians were induced to settle in the north of Ireland, which the English government had taken away from the native Catholic Irish. Naturally the native Irish hated these intruders, while the Scotch-Irish viewed the dispossessed natives with disdain and treated them harshly and even brutally. At the end of the seventeenth century the English Parliament passed laws restricting and even prohibiting the manufacture of certain classes of goods which the Scotch-Irish had developed to a remarkable degree. To make mat-

ters worse, a law was passed at the beginning of the eighteenth century which prohibited a man from holding public office unless he had taken the Sacrament according to the rites of the Episcopal Church. Thus the Presbyterians were excluded from the magistracy, customs, excise, post office, judicial, and municipal offices. Threatened with economic ruin and deprived of all voice in their own government, the Scotch-Irish who were not rooted in Ireland by tradition, turned to the new world. So many of them emigrated in the course of the eighteenth century that the depopulation of North Ireland for a time seemed imminent. Prior to the Revolutionary War it is estimated that there were in the colonies more than 350,000 Scotch-Irish, of whom probably a fourth settled in Pennsylvania.

These Scotch-Irish brought with them a propensity for conflict and fighting which they had perforce acquired in Scotland and Ireland. To them there appeared no reason why deference should be shown to copper-colored savages of the wilds of Pennsylvania. Without any formality, therefore, they occupied the lands of the Indians, and did not hesitate to kill those who offered to resist. Thus they became the typical frontiersmen.

There is, however, a brighter side to the history of the Scotch-Irish in Pennsylvania. In Scotland their ancestors had always been noted for their interest in education, and in the colony they themselves stood second only to the Quakers in their efforts to raise the intellectual standard. Their

greatest significance to the province, however, lies in the fact that they were the most potent force in Pennsylvania to support the War for Independence. Coupled with their hatred for the English was their traditional love for self-government. To be sure, the Germans, likewise, desired freedom, but they were politically too immature to take the lead in revolution. This rôle, therefore, fell to the descendants of the heroes who centuries before had fought England at Bannockburn. Many years of experience had taught them how to assume political leadership.

It should not be supposed that the diverse nationalities in Pennsylvania were immediately fused into a homogeneous political organization. The Scotch-Irish, the Quakers, and the Germans had too many distinctive traits to be united readily into a harmonious unit. The Scotch-Irish despised the non-resisting Quakers and the German Mennonites and Dunkers, while the quiet conservative German Lutherans and Reformed hated the boisterous and pugnacious Scots. In spite of this situation, however, the Revolutionary War kindled a common bond of feeling and did much to create a spirit of unity among them. All the elements in the population of the colony at last realized that freedom and independence were ideals common to all and that to secure them concerted political and military action were absolutely essential. Inspired by these considerations, the various elements in Pennsylvania's population contributed in no small way to the winning of independence and incidentally realized for

the first time the necessity for unity of action in the affairs of the commonwealth.

To be sure, many of the evidences of localism remained after the Revolution. The Scotch-Irish in the western part of the State refused to pay the whiskey tax which the National Government levied, and threatened the tax-collectors. They considered the imposition of such a tax as an attack on their independence. Order was not restored until Washington called out the militia. A few years later, in 1798, the Germans in the vicinity of Bethlehem maltreated United States officials who were attempting to collect the tax on window panes, which had just been authorized by Congress. The Germans declared that such a tax was a serious infringement on their liberties, since even the light from Heaven was being taxed. The disturbance assumed such threatening proportions that President Adams felt constrained to call out the militia of the neighboring states. The two uprisings, one in the western and the other in the eastern part of the State, show that the same spirit of localism was animating both the Scotch and the Germans.

One other element of Pennsylvania's population should be mentioned. As early as 1755 surveyors from Connecticut laid out tracts of land in the Wyoming Valley, in the northeastern part of the State. Connecticut claimed this land by virtue of her charter of 1662, and settlers from this state poured into the valley. Although the Pennsylvania government attempted to drive them out or to bring

them under its control, Connecticut had control of the valley up to 1782 when a body of commissioners decided that the disputed land belonged to Pennsylvania. The question was not finally settled, however, until 1799, when it was decided to allow the Connecticut settlers to retain their homes in return for a small payment of money to the government of Pennsylvania.

Toward the middle of the nineteenth century a new stream of foreign immigrants began to pour into the State. First among these were the Irish and Germans, and finally a medley of nationals from southeastern Europe including the Hungarians, Slavs, and Italians. These later immigrants, in contrast to the early settlers, were mostly Catholics. According to most authorities, there were only about three thousand Catholics in the Colony in 1775, whereas in 1910 approximately 40 per cent of the population was Catholic.

All the land of Pennsylvania was practically opened to settlers by the year 1800. Naturally migration and settlement usually followed the lines of least resistance, that is, the river valleys and the mountain passes. Thus, the land along the Lehigh and Susquehanna rivers was soon dotted with settlements and farm-houses. Even the region drained by the Allegheny and Monongahela rivers was rapidly filled by settlers after the close of the French and Indian War in 1763, although this part of the State was not easily accessible by a direct route from the eastern section. It was more readily

reached by way of the Great Lakes and through the Cumberland Gap from Virginia.

No sooner had settlers occupied the remote western part of the State than they began to demand more and better facilities to transport their products to the eastern markets. To be sure, a few roads had been built prior to the Revolution. For example, the Queen's Road from Philadelphia to Chester was completed in 1706 and also a road from Philadelphia to York in 1711. These colonial roads, however, were of dirt. In 1792 a number of men organized a stock company to build a road from Philadelphia to Lancaster. Although this highway originally was poorly constructed, owing to the inexperience of the builders, it soon became through improvements the finest road in America. Its importance can readily be seen when one recalls that it ran from what was then the largest city in the country to the heart of the richest farming lands of the commonwealth. The road was soon dotted with large Conestoga wagons in which the German farmers of Lancaster County hauled their agricultural products to the Philadelphia markets. Encouraged by the success of this venture, other companies as well as the national and state government began to construct turnpikes, with the result that by 1831 there were twenty-five hundred miles of such roads in Pennsylvania.

Another very potent cause for the improvement of transportation facilities in Pennsylvania was the rivalry between New York, Philadelphia, and Balti-

more to secure the trade of the Ohio Valley. Since no natural barriers existed in the route by way of the Hudson and Mohawk River valleys, New York had a distinct advantage in this competition. In 1816, for example, it was possible to transport goods from New York to Pittsburgh for six dollars a hundred pounds. The Philadelphia merchants realized that they must bestir themselves. Therefore, in 1817, they organized a company and collected thirty-five thousand dollars for establishing a wagon line to Pittsburgh. In the following spring, this company started two wagons daily to Pittsburgh, where they usually arrived at the end of the twelfth day. In a few months the freight rates from Philadelphia to Pittsburgh were reduced to six dollars and a half a hundred pounds. The establishment of this line not only placed this through traffic on a firm basis but also stimulated local trading all along the route.

However, transportation by wagon was destined soon to be superseded by canal facilities. With the completion of the Erie Canal in New York in 1825, the Pennsylvania wagon route to Pittsburgh was hopelessly outdone. Accordingly, the State legislature authorized the construction of a canal or rather a series of canals from Columbia on the Susquehanna River to Pittsburgh. A canal from Pittsburgh to Johnstown along the Allegheny and the Conemaugh rivers was completed in 1830. In the same year the series of canals between Columbia and Huntingdon were put into operation. There

remained to be constructed a canal between Huntingdon and Hollidaysburg and an inclined plane railroad over the thirty miles of mountainous country between Hollidaysburg and Johnstown. By 1834 these obstacles had been surmounted and the system was completed. Freight could now be transported from Pittsburgh to Columbia without being unloaded; from Columbia to Philadelphia the journey was made by railroad.

Notwithstanding Pennsylvania's heroic effort to compete successfully with the Erie Canal, the volume of through trade on the main line of the Pennsylvania Canal never approached that of its New York rival. It should be stated, however, that the local trade over the entire canal system of Pennsylvania compared favorably with that of the New York State canals. In 1844 the traffic passing to and from the central states over the Erie Canal was more than 350,000 tons; in the same year the through traffic over the Pennsylvania Canal was less than 75,000 tons. The cost of transportation across Pennsylvania was much greater than across New York, a situation caused partly by the high cost of maintenance of the locks in the central part of the State and partly by the expensive system of inclined planes between Hollidaysburg and Johnstown. The danger seemed indeed threatening that Philadelphia and Pennsylvania would be entirely eliminated from participation in western commerce.

The outlook became even more gloomy when

direct steam rail connection between Boston and Albany was established in 1841. Prior to this event Philadelphia had served as the transfer point of much of Boston's manufactured products that were being shipped to the West, while the Pennsylvania farmers had found a ready market for their surplus agricultural products in New England. Immediately, however, the Boston merchants began to send their goods to the West by way of Albany, and the people of New England obtained their foodstuffs from the Ohio Valley. In a single year, 1846, for example, 361,000 barrels of flour were transported by the railway from Albany and Troy to the New England cities.

Spurred by the fear of losing all western trade and encouraged by the success of the Boston and Albany railroad, a number of Pennsylvania business men applied for a charter to build a railroad from Philadelphia to Pittsburgh. The State government, which had no desire to repeat the expensive experiment of building transportation lines as it had done in the case of the canals, readily granted the desired charters in 1846. Work on the new road was begun immediately and on December 10, 1852, the first cars were despatched from Philadelphia to Pittsburgh. The completion of the railroad was not achieved a moment too soon, since competing roads in the neighboring states were finished about the same time. The New York Central made through connections with the Great Lakes in 1850. The Erie reached Dunkirk on Lake Erie in 1851, and the

Baltimore and Ohio was completed to Wheeling in 1853. As a result of the building of these roads, trading between the Atlantic states and the Ohio Valley received an enormous stimulus, a situation for which the Pennsylvania Railroad was largely responsible.[1]

While the development of inter-state transportation facilities was going on apace, the construction of transport lines for the moving of products within the State was by no means lagging. The necessity of more canals became apparent when the coal fields began to be developed. In 1820 Josiah White and Erskine Hazard, the organizers of the Lehigh Coal and Navigation Company, completed a canal from the Mauch Chunk coal fields on the Lehigh River to the confluence of the Lehigh and Delaware rivers, a distance of eighty-four miles. This canal was extended to Bristol in 1830, thus bringing coal to the door of Philadelphia. In 1826, the Schuylkill Navigation Company opened a canal extending from Port Carbon to Philadelphia. Likewise the Wayne County coal district was tapped in 1828 by a canal running from Honesdale to the Hudson River. The northern reaches of the Susquehanna River were canalized. Also in 1827 the State began to build a canal which extended from the Ohio River to Lake Erie in the northwestern part. It was completed in

[1] The State sold the old Pennsylvania Canal in 1857 to the Pennsylvania Railroad Company. By 1864 the canal had been abandoned west of Hollidaysburg, but the eastern division was used forty years longer for the transportation of coal and stone.

1844 and served largely as a means of transporting coal.

The canals constructed primarily for the purpose of moving freight within the State eventually suffered the same fate as those built for interstate commerce. Most of them were abandoned, owing to their inability to compete successfully with the steam railroads. To be sure, this fate of the canals was not apparent in the beginning. Indeed the first steam locomotive in America, the Stourbridge Lion, was used in 1829 by the Delaware and Hudson Canal Company on a service road which it built between Carbondale and Honesdale, a distance of about sixteen miles. In 1833 the Philadelphia and Reading Railway Company was incorporated, and completed five years later. It extended from Philadelphia along the Schuylkill River into the heart of the anthracite coal region. In the same year that the Pennsylvania Railroad Company was incorporated, 1846, a charter was granted to the Lehigh Valley Railroad Company. This road was also built primarily for transporting coal.

From the very beginning of the railway movement Pennsylvania has been noted for the large railway mileage that it possessed. In 1835 it was estimated that Pennsylvania had two hundred miles, or 25 per cent of the entire mileage of the country. The increase in number of miles from that day up to the present has been very marked. In 1916, the State could boast of 11,691 miles of steam railroads, being exceeded only by Texas and Illinois. It had

almost twenty-six miles for every hundred square miles of territory; New Jersey and Massachusetts being the only states that surpassed it in this respect. In addition to steam railways, there were in the State in 1918 almost 4,750 miles of electric railways in operation.

Side by side with the development of better transportation facilities in Pennsylvania came the evolution of many industries. The first iron forge in the province was probably erected by Thomas Rutter near the present borough of Pottstown, about the year 1717. Steel was manufactured at Coventry, Chester County, as early as 1732. The most famous of all the colonial factories of iron goods was the one at Elizabeth, Lancaster County, owned by Baron Wilhelm Stiegel. While the manufacture of iron and of iron goods was a considerable industry in the colonial days, its great expansion naturally occurred after the American Revolution. As early as 1789 there were fourteen furnaces and thirty-four forges in operation in the State, none, however, west of the Alleghenies. After the Revolution the iron manufacturing centers in the State rapidly moved west. During the period from 1810 to 1842 more iron was produced in Center and Huntingdon counties than anywhere else in the country. The beginning of the iron industry in Pittsburgh dates back to 1792, when George Aushutz built a furnace at that place. The industry at Johnstown started in 1807. In 1840, David Thomas began to operate an iron furnace at Catasauqua; this was the fore-

runner of the industry that developed into the Bethlehem Steel and Iron Company.

One of the most noticeable features in the development of the iron and steel industry of Pennsylvania, as well as of the entire nation, is the increased percentage of iron that was converted into steel. Comparatively little steel was manufactured before the introduction of the Bessemer process, which was first used in Pennsylvania at Steelton in 1867. The man, however, who first grasped the importance of the new process was Andrew Carnegie. On a trip through England in 1868 he noticed that steel produced by the new method was much superior to that obtained by the old. Accordingly, on his return to Pennsylvania, he installed Bessemer converters in his steel mill. The production of steel was still further stimulated when the open-hearth process began to be used in this country. In 1909 Pennsylvania produced almost 11,000,000 tons of pig iron, while the yield of the entire nation was about 25,500,000 tons. The total production of steel in the Union in 1909 was 26,723,274 tons and in Pennsylvania 12,189,953 tons. Needless to say, the State stood first in the manufacture of both iron and steel.

A State that is so preëminent in the iron and steel industry should have easy access to large beds of coal. Fortunately, both anthracite and bituminous coal are found in large quantities in Pennsylvania. In 1917 practically one-third of the bituminous output of the nation was derived from the

mines in the western part of Pennsylvania, while almost all of the anthracite mined in the country comes from the hard coal fields in the northeastern part of the State.

The history of the development of the demand for anthracite is especially interesting. As early as 1776 James Tilghman wrote that "a bed of anthracite coal had been found in the Wyoming Valley, and that it may some day or other be of great value." In 1778 hard coal was used by some blacksmiths in their forges. The great objection to it, however, was that it "would glow but not burn." In 1803 two hundred tons were sent to Philadelphia, but since no purchaser could be found it was thrown away. Nine years later a man who attempted to sell several wagonloads in the same city was threatened with arrest on the charge of obtaining money under false pretences.

However, Jesse Fell of Wilkes-Barre had succeeded in burning anthracite coal in an open grate in 1808. Four years later a chance event at last proved the utility of anthracite in manufacturing. At the falls of the Schuylkill River Josiah White and Erskine Hazard had entered into a partnership in the wire-making business. They bought a cartload of hard coal at one dollar a bushel, but they used up the whole load without obtaining the necessary heat. Although much discouraged they purchased a second cartload. After another vain attempt in which they labored unsuccessfully with the coal for a whole night, they finally gave up in

despair, closed the doors of the furnace and went home. Half an hour later one of the workmen to his great amazement found that the coal in the furnace was red hot! It was a chance discovery but one of first-rate importance.

Convinced of the utility of anthracite coal, White and Hazard leased for twenty years the coal fields lying back of Mauch Chunk, and constructed in 1820 the canal along the Lehigh River, as already mentioned. Then they began a campaign of education among the people. Grates were made; stoves were kept continually burning in public places; and firemen were instructed in the factories. As a result of these efforts, the sale of hard coal in Philadelphia increased from 365 tons in 1820 to 80,000 in 1828. From this time to about 1870, anthracite was almost the only fuel employed in factories. Then it began to be supplanted by coke and bituminous coal, so that at the present time hard coal is scarcely used for manufacturing purposes. Of course, soft coal was used and appreciated long before hard coal, but since the deposits of the former were so far from the factories and since its transportation was very difficult and expensive, it did not obtain its present preëminent position prior to the last quarter of the nineteenth century.

Pennsylvania was the first state in the Union to experience the discovery of oil in large quantities. Indeed the first oil company in the country was organized in Pennsylvania about 1850 by a man named Bissell. Edwin Drake, one of the stock-

holders of this Pennsylvania Rock Oil Company, as it was called, evolved the idea of driving a tube into the ground. The experiment was successful, twenty-five barrels of oil being taken from Drake's well at Titusville in 1859. Then the scenes familiar to those who experienced the California gold fever of '49 were repeated in the northwestern part of Pennsylvania. Men became fabulously rich over night. For instance, a merchant at Titusville bored a well which delivered sixty gallons a minute; and within two years the farm on which this well was located had yielded one hundred and sixty-five thousand barrels of oil. At first the crude petroleum was carried to its destination in wagons and in boats, but in 1864 Samuel Van Syckel built a pipe line, four miles in length. This method of transportation gradually replaced to a great extent all others. The first refinery was probably built at Corry in 1862. The State retained its premier position as an oil-producer up to 1894. In 1917 it stood eighth in total production of petroleum with more than eight and one-half million barrels.

In the manufacture of other goods Pennsylvania takes highest rank. It leads in the manufacture of cement, lime, mineral paints, sand, gravel, slate, and stone. It is second in clay products and natural gas. In 1909, it was also first in the manufacture of glass, second in cloth, and fifth in the making of paper and wood-pulp.

The manufacture of each of these articles has an interesting history. The textile industry in the

State, for example, dates back to 1683. Most of the earliest German immigrants were weavers from the vicinity of Crefeld and Mannheim in the Palatinate. By 1770 weaving had become a very important occupation in the colony. Between May, 1769, and May, 1770, it was reported that more than 33,000 yards of cloth were woven in the city of Lancaster alone.

The making of glass had also assumed large proportions before the Revolution. The most famous glass factory in the colonial days was owned by Wilhelm Stiegel. It was located at Elizabeth, Lancaster County, near Stiegel's iron furnace. When some of the products of this glass factory were exhibited before the American Philosophical Society in Philadelphia, the newspapers declared it was as fine as European glassware. Benjamin Franklin, on the other hand, declared it "a coarse ware."

The history of the manufacture of paper in the State also began within ten years after the settlement of Philadelphia. In 1690 William Rittenhouse started the first paper mill in America on a branch of the Wissahickon Creek near Philadelphia. In 1726 the second paper mill in the colonies was also established in Pennsylvania by Thomas Wilcox. For a long time the State retained the lead in this industry. In 1810 Isaiah Thomas estimated that there were 195 paper mills in the country and that sixty of them were located in Pennsylvania, twenty more than in Massachusetts, which ranked second. Even at the present time Pennsylvania enjoys a

high position among the states manufacturing paper, a fact which is due to its large supply of timber. Up to 1880 it was first as a lumber center, but since that time it has been passed by a number of other states.

While the manufacturing industries were being developed in Pennsylvania the value of farm products and of farm property also steadily increased. According to the 1910 Census the State stood thirteenth in the value of farm property. In 1915 it was ninth in order of value of all its crops, as compared with the other states. One of the most encouraging signs in the agricultural field is the interest shown by the citizens of the commonwealth in agricultural education. In 1855 several citizens, encouraged by the State Board of Agriculture, obtained a charter from the Pennsylvania Legislature to establish a "Farmers' High School," which was opened in Center County in 1859. Three years later the name was changed to the "Agricultural College of Pennsylvania." In the same year Congress passed the Morrill Act which offered gifts of public lands to the various states for the purpose of encouraging higher education, especially in agriculture and the mechanic arts. The State Legislature accepted the offer in 1863 and the Agricultural College was made the recipient of the gift. In 1874 the name of the College was changed to "The Pennsylvania State College."

In other fields of education the State has also made steady and continuous progress. In colonial

days an elementary education could be secured only in private schools. The Constitution of 1790, however, provided that schools should be established throughout the State "in such a manner that the poor may be taught gratis." Beginning with 1802 there was a series of laws to carry out the idea of free public education, but nothing really effective was done until the passage in 1834, after a very bitter contest, of the law which proved to be the basis of elementary education in Pennsylvania. Each township and borough was made a school district. Later developments have made elementary education not only free but compulsory.

With the increasing diversity of industries and the consequent movement of the population from rural to urban communities, new social problems have naturally made their appearance. Any extended period of industrial or financial depression causes discontent among the wage-earning class and labor disturbances occasionally occur. Since, for a number of years, Pennsylvania has had the second largest number of wage-earners in the Union, it has been the scene of frequent strikes. As early as 1868 a strike occurred in the coal region. In 1874 the State militia had to be sent to Susquehanna to suppress the disorder incident to a railway strike on the Erie Railroad. From January to July, 1885, there occurred the "long strike" in the Lehigh and Schuylkill coal regions. The most serious of the early strikes, however, was the National Railroad strike of 1877. In Pennsylvania the railroad bridge

Plate IV. A wheat field on the farms of The Pennsylvania State College.

over the Schuylkill at Reading was burned and rioters in Pittsburgh destroyed much property. As labor became better organized, and the State took precautions to prevent rioting, the strikes became less violent but much longer in duration. Thus, the Homestead Steel strike of 1892 lasted for five months, and the anthracite coal strike of 1902 for six months. In order to cope with strikes more effectively, the State constabulary was organized in 1905. This consists of a small band of disciplined uniformed men who are in continuous service. Their first duty is to protect life and property and to preserve peace.

Within recent years a number of State laws have been passed intended to offer relief from some of the undesirable social conditions in modern industrial life. Such statutes as the Child Labor Law, the Workmen's Compensation Act, and the Vocational Education Law, may be regarded as precursors of other legislative enactments that improve the laboring man's condition and hence eliminate partially the discontent that so often breeds disorder.

In conclusion, it appears that the outstanding characteristic of Pennsylvania is the striking diversity of its wonderful natural resources, of its enormous industries, and of the sources of its population. While it has not been possible in so short a time to mold the stream of Quakers, Germans, Irish, Italians, and many others into one absolutely homogeneous population, there has been, nevertheless, a

profound State unity and consciousness running through the history of the commonwealth. Moreover, each element in the population has contributed materially to the tremendous economic development of the State. With a population second only to that of New York and with natural resources greater than any other state in the Union, Pennsylvania bids fair to hold its present industrial supremacy for many years.

CHAPTER V

SURVEY OF AGRICULTURAL INDUSTRIES IN PENNSYLVANIA

THE agriculture of Pennsylvania is more extensive and important than anyone who has not studied it would suppose. The principal thoroughfares of the State generally pass through narrow valleys and the traveler sees the poorer farming districts or none at all. Agriculture as an industry is also somewhat overshadowed by the important mining and manufacturing interests.

As compared with other states of the Union, Pennsylvania ranks thirty-first in land area, but stands much higher in production and value of agricultural products. In 1910 it was thirteenth in value of all crops and in 1920 it rose to seventh rank. Land values, number of farms, and size of farms in Pennsylvania have been less subject to change during the last half century than in the southern or central western states. Of the land area of the State 69 per cent was in farms in 1880. Since then the land in farms has been reduced by over 2,000,000 acres and in 1920 only 61.5 was in farms, of which 67.1 per cent was improved land.

The number of farms in Pennsylvania reached

the maximum in 1900, at which time there were 224,248. Since then the number has diminished and in 1920 there were only 202,250 farms, or a reduction of 21,998 in a period of twenty years. Pennsylvania is not alone in a decrease in numbers of farms in recent years. From 1910 to 1920 all of the states north of the Ohio River from Illinois to the Atlantic coast showed a reduction. The percentage decrease for the six new England states, New York, and New Jersey was much larger than in Pennsylvania. In New Hampshire it was 24.1 per cent, Rhode Island 22.8, Maine 19.6, Connecticut 15.5, Massachusetts 13.4, Vermont 11.1, New York 10.5, New Jersey 11.4, and Pennsylvania 7.8.

The reduction in number of farms is due to: (a) the combining of small farms to make farms of a more profitable size; (b) the conversion of farms into suburban sites in the vicinity of cities; and (c) the actual abandonment of a considerable number of farms in the poorer districts. The average size of farms increased 2.5 acres from 1910 to 1920. This area added to each of the 202,250 farms in 1920 would be sufficient to make 5,962 farms of the size that prevailed in 1910. Allegheny County, in which the city of Pittsburgh is located, shows a reduction of 1,000 farms from 1910 to 1920. In Berks County, with Reading as the chief city, the reduction was 900, and in Philadelphia County the number of farms fell from 824 in 1910 to 423 in 1920.

Low land values are generally associated with low crop production and the necessity of larger farms in order to make a living. With low land values and low production there is a marked tendency to increase the size of farms. This is illustrated by the increase in size of farms from 1910 to 1920 in Potter, Tioga, Bradford, and Susquehanna counties. In the latter year land values in these four counties averaged less than $18 an acre and the average size of farms was 126 acres as compared with 109.6 acres ten years earlier, an average increase of over sixteen acres a farm in ten years.

In Butler, Cumberland, and Lancaster counties, with land values at $42, $56, and $82 an acre, respectively, there was a decrease in size of farms and an increase in number. In Butler County the size of farms during the last decade decreased from 81.4 to 77.8 acres and was accompanied by an increase of 200 farms. In Cumberland County in the same period the size decreased 1.7 acres and the number increased 72. In Lancaster County the size decreased 1.7 acres and the number of farms increased 471. In Lancaster County the average size of farm in 1920 was 49.1 acres and average value of all farm property to a farm was $10,589. In Potter County, where the average value of land was only $20 an acre and with farms averaging 141 acres, the average value of all farm property to a farm was $5,747. The question arises as to whether farmers in Lancaster County make larger net in-

comes than those in Potter County. The census figures are not sufficiently complete to make possible an answer, but they show that the average value of crops to a farm less the gross expenses for labor, feed, and fertilizers is larger for Lancaster County by $909.

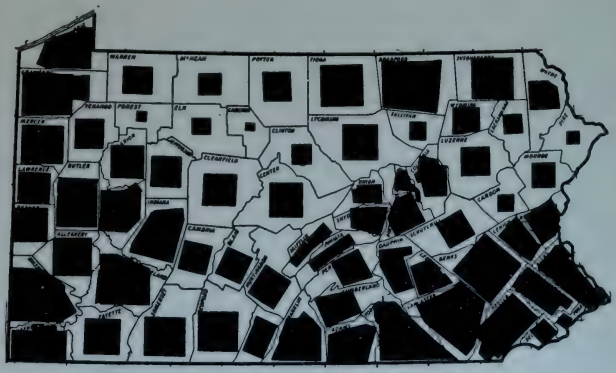

FIG. 16. Relative area of improved land by counties, compared with the area of the respective counties, Census of 1920.

Acres of land to a farm is not as good a measure of size of business or net income as is the capital invested in land, buildings, stock, and equipment.

The counties having the largest proportion of their land area in farms are: Bucks, Chester, Erie, Greene, Lancaster, Montour, Washington, and York, with range of 85.0 per cent of the area in farms for Chester County to 95 per cent for Greene County. Those having the smallest percentage of land in

farms are Cameron 10.5, Elk 12.7, Forest 16.4, and McKean 24.1.

The counties with the largest percentage of the farm land improved are Berks, Bucks, Cumberland, Greene, Lancaster, Lebanon, Lehigh, Montgomery, Northampton, and Washington with 82.5 to 86.6 per cent. Those having the smallest percentage improved are Cameron 33.5, Elk 43.9, McKean 44.2, and Pike 14. The accompanying map (Fig. 16) shows the relative area of improved land by counties. The average value for all farm property is $8,551 a farm or $41.12 an acre. Those counties in which the average value a farm is above $10,000 are: Allegheny, Chester, Cumberland, Delaware, Franklin, Greene, Lancaster, Montgomery, and Washington. In several the high value is based on prospective building sites. In only three counties, Elk, Forest, and Sullivan, do average values a farm fall below $5,000.

The value of all farm property in Pennsylvania in 1920 was $1,729,353,034. This was only 38 per cent higher than it was ten years earlier. The value of farm property has the following distribution: Land 42 per cent, buildings 34 per cent, implements and machinery 10 per cent, and live-stock 14 per cent. With only 41.3 per cent of the area in improved farm land, it is at once evident that there is room for considerable expansion in the agricultural industry. How much of the 58.7 per cent of land not utilized for raising crops can be employed profitably in the next few decades will depend on

economic conditions and the extent to which science and investigations can find ways and means of using it. This is one of Pennsylvania's big problems and it is the judgment of the writer that considerable of this land will offer opportunities for the pursuit of agriculture to the rising generation.

In thirty-four counties rural population has decreased since 1880 and in three counties there has been no change. In several counties the decrease in rural population is very large. In Pike County it is 48 per cent, in Susquehanna 44, Bradford 37, Crawford 30, Juniata 29, Perry 28, Wyoming 24, McKean 23, Tioga and Wayne each 22, Clarion 21, and Venango and Cameron each 20 per cent.

The agricultural rank of each of the sixty-seven counties of Pennsylvania, based on acres of the ten principal crops and the animal units for each, are given in Appendix F. The rank for the ten principal crops follows closely the agricultural status which is based on both crops and animals; in fact, it is identical for fifteen counties and differs not to exceed three places for thirty-five other counties. This table shows at a glance the relative importance of the several crops by counties. For example, in Lancaster County corn, wheat, tobacco, potatoes, and hay are the leading crops, and buckwheat, rye, barley, and oats are relatively unimportant. In Bradford County buckwheat, hay, silage and oats, are important while corn and wheat are relatively unimportant. Cameron County ranks sixty-seventh or last in agriculture as well as for all crops. It also holds last place for corn,

wheat, rye, barley, and potatoes. The rank of fifty-one for buckwheat indicates that it is of considerable relative importance and by reference to the actual acreage of the several crops it is exceeded in acreage only by hay and oats. This table also shows the leading counties in production of any crop. For example, the counties leading in acreage of hay in order of importance are Bradford, Crawford, Tioga, Lancaster, Erie, York, Susquehanna, and Berks. In tobacco Lancaster, York, Chester, Lebanon, and Berks lead.

Appendix G indicates the rank for the several classes of live-stock by counties as compared with the agricultural status and that for total animal units. There is a close agreement between the rank by total animal units and the agricultural placing. In seventeen counties it is identical and in thirty-four other counties it differs by not more than three places. Of the several classes of animals, horses and poultry most closely follow the agricultural rank. For any other classes the status may be very different. The table, therefore, shows the character of animal production that dominates each county. In Lancaster County cattle, swine, dairy cows, and poultry are most important. In Bradford dairy cows lead, sheep and cattle are of secondary value, and swine are unimportant. In Greene County sheep and beef cattle lead and dairy cows are of little importance. The five leading sheep counties are Greene, Washington, Mercer, Crawford, and Bradford. The five leading swine counties are Lan-

caster, York, Berks, Franklin, and Bucks. In ascertaining the total animal units seven sheep, five swine, and 100 head of poultry are taken as a unit. In case of the larger animals no allowance has been made for the young. The census of 1920 was taken as of January 1, when the numbers of young animals were small. The earlier census enumerations were taken on April 15, prior to which a large part of the spring crop of young were born. This will account for a part of the decrease in numbers from 1910 to 1920.

There is no very sharp division of the farming in Pennsylvania into types. A very large part may well be called the general and live-stock type. Lancaster, York, Berks, Franklin, Cumberland, and Bucks counties are good examples. In Lancaster, tobacco is a big cash crop and the feeding of steers is stressed. In Franklin County wheat is the leading cash crop. In Adams County orcharding is combined with the general and live-stock enterprises, while in Bucks and Montgomery truck crops for the Philadelphia market form an important addition to the general enterprise. In most of these counties all of the roughage and most of the concentrates for the live-stock are produced on the farm and one or more crops are grown for direct sale.

From 1880 to 1900 the balance between crops and live-stock was uniform. For each 100 acres of crops there were 37.3, 37, and 37.7 animal units for each of the census years 1880, 1890, and 1900, respectively. In 1910 the animal units declined to 34.6

and in 1920 to 33.7 for each 100 acres. While this is not a marked reduction, it indicates the trend that will probably prevail for many years. Poultry will presumably continue to increase in numbers in about the ratio of growth in population. Dairy cattle and swine will hold their own and may increase slightly, while a decline in numbers of horses and beef cattle will probably continue. The marked decline in sheep will doubtless be arrested and the numbers may increase to some extent. There is room on many farms for a small flock of sheep with very little expense for feed. They utilize feeds that would otherwise be wasted. The same conditions also prevail with moderate sized flocks of poultry. They gather most of their living from grain about the feed-lots.

In the northern tier of counties, dairy farming predominates. The glaciated soils of that region, together with the low price of land and the short growing season, favor the production of pastures and hay, which furnish a considerable part of the roughage for dairy cattle. Corn is grown for the silo but very little for grain. Most of the concentrates are purchased. The major portion of the dairy products is shipped as market milk to New York City and Philadelphia. The leading dairy counties in this region are Bradford, Crawford, Erie, Susquehanna, Tioga, and Wayne.

In the immediate vicinity of Philadelphia, Pittsburgh, and other large cities are many dairy farms that either ship or retail milk to the local market.

With the exception of Chester County, in which dairy farming predominates, the number of these farms in other sections is not sufficient to establish dairy farming as the leading type.

Live-stock farming predominates in Erie, Crawford, Mercer, Washington, Greene, Westmoreland, Bedford, and Somerset counties. These lie in western and southern Pennsylvania. In Crawford and Mercer counties considerable dairying is combined with live-stock farming. In Washington and Greene counties sheep predominate. The large proportion of rough steep land in these counties, adapted to grass, together with climatic conditions favoring the feeding of cattle and sheep, and the cheap shelter of the same, encourage live-stock production.

Since 1900, forty-eight counties have decreased in total acres of crops and nineteen have increased. During the same time total animal units have decreased in fifty-eight counties and increased in only nine, and animal units to 100 acres of crops have decreased in fifty-one counties and increased in sixteen. In 1920 animal units to 100 acres of crops ranged from a minimum of 23.3 in Jefferson County to a maximum of 62.1 in Wayne County. Other counties with a large number of animal units to 100 acres of crops are Greene with 58, Susquehanna 55, Warren 51, and Lackawanna 50.

While special farming has increased relatively in recent years, it is at once evident from a study of agricultural statistics that in Pennsylvania general

farming predominates. The table in Appendix H throws some light on the importance of the principal field crops as compared to the acreage and value of all crops. It omits crops of minor importance such as soybeans, navy beans, peas, flax, millet, sorghum,

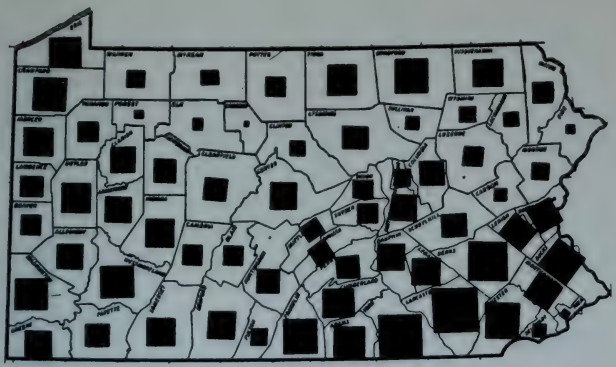

FIG. 17. Relative area devoted to ten principal crops—corn, oats, hay, wheat, barley, buckwheat, rye, potatoes, alfalfa, and tobacco.

broom-corn, and others. The acreage of all crops reported in the 1920 Census for Pennsylvania was 7,871,483, valued at $409,968,877, or an average of $52 an acre. The relative acreage of the ten crops by counties is shown on the map (Fig. 17).

The question as to whether there has been any marked change in the total acreage of general farm crops or the relative acreage of the principal ones during a half century may best be answered by a

study of crop statistics as reported by the United States census every ten years. In making comparative studies, acres of crops grown is more satisfactory than yield or production. Yield is influenced so greatly by weather that abnormal seasons increase or decrease production, while acreage of the crop studied may remain constant.

Prior to 1880 the census reported production of staple crops, but did not give the acreage. From 1880 to 1920 both acres and production have been reported. The figures for the even years are always for the crop year just preceding, that is, 1879, 1889, 1899, 1909, and 1919. Appendix I reports acreage of principal field crops. A study of this table shows a very stable condition of Pennsylvania agriculture so far as it relates to general farm crops. There has been no violent change or fluctuation either in the total acreage of the ten crops or in any one of them, except alfalfa, a new crop in 1900, which has increased rapidly in acreage. The total acres reached the maximum in 1900. In this year corn and wheat were also at the maximum. In 1920 the total acreage of all crops was nearly the same as in 1880, forty years earlier.

The census figures are not sufficient to make possible an accurate estimate of the average net income to a farm, but the value of all crops less the expenditures for labor, feed, and fertilizers will probably approximate the net income. Feeding crops to live-stock increases the gross income but also adds to the expense, often to such an extent that the net

income is not augmented. This was true on many farms in 1919 when crop values were very high.

The value of all crops on a farm in 1919 as reported in the 1920 census ranges from a maximum of $3368 for Franklin County to a minimum of $828 for Pike County. The value of all crops less the expenditures for labor, feed, and fertilizers ranges from a maximum of $2,801 for Cumberland County to a minimum of $164 in Delaware County. Grouping the counties according to the number of animal units to 100 acres of crops gives the following results:

ANIMAL UNITS	NUMBER OF COUNTIES	VALUE OF ALL CROPS LESS EXPENSES A FARM		
		LOWEST	HIGHEST	AVERAGE
23–27	14	$1040	$2801	$1771
28–31	26	882	2778	1790
32–35	8	894	1895	1350
36–39	7	737	2060	1291
40–45	11	536	1563	1011
46–62	7	164	1259	801

From the above it is evident that the returns to a farm from crops are largest when the animal units to 100 acres of crops do not exceed 32. Beyond this number there is a rapid decline in returns and farms having more than 40 animal units to 100 acres of crops are overstocked, and are not as successful as those with moderate numbers. In the northern part of Pennsylvania are sixteen contiguous counties, including all of the north tier, in which no county has less than 36 animal units to 100 acres of crops, the average number for the sixteen

being 44.2. In these counties the net value for crops to a farm averages only $1006. In the southeast corner of the State are five contiguous counties in which none has less than 37 animal units to 100 acres of crops, the average for the five being 46.9. For those counties the average net value for all crops was $1,090 a farm. In the south central part of the State are twenty-two contiguous counties, in no one of which there are more than 33 animal units to 100 acres of crops, the average being 28.5. In these counties the net value a farm for all crops was $2,060, with no county falling below $1,695. This section appears to be the most prosperous agricultural one in the State and lies almost wholly outside of the coal, oil, and gas regions and its only cities of importance are Harrisburg, York, Altoona, and Williamsport. It has a well balanced system of agriculture and most farms have several important enterprises from which to realize returns.

CHAPTER VI

PLANTS AND CROPS OF PENNSYLVANIA

Corn, oats, wheat, and hay are the leading crops of Pennsylvania and form the basis of a rather definite rotation. The acreage suggests that on an average corn, oats, and wheat are grown one year each and hay two years, thus forming a five-year rotation. In some localities hay remains for one year only, in some for two years, and in others it is continued as long as it will produce a moderate cutting of fair quality. In the southern and central portions of the State it is usually seeded with winter wheat, but in the northern part it is seeded with oats, rye, or buckwheat.

Rye has shown a steady decrease in acreage and the same is true for barley except for the last decade, which shows an increase over the preceding two periods.

Potato production increased steadily until 1910, since then it has declined. This crop is destined to become more important.

Tobacco shows no change for three decades, but increased rapidly from 1900 to 1910.

GRAIN CROPS

Corn succeeds best on well-drained loamy soils of good fertility and is also dependent on climatic conditions. It is favored by a warm humid atmosphere and plenty of rainfall in July and August. In the northern part of the State and at elevations of 1,500 feet or more, the season is short and the nights usually cool so that corn is not extensively grown and only the earliest kinds are planted for grain. In such localities flint corn is common.

The optimum date for planting corn ranges from May 1 at low elevations in the southeastern part of the State to June 1 at high elevations in the northern portion. When the oak leaves are the size of a squirrel's ear is said to be time in that locality to plant corn.

Corn is usually spaced in rows 40 to 44 inches apart, one kernel in a place at intervals of about 14 inches in the row. It is usually cultivated three to five times during its early growth, to prevent weeds, keep the soil aërated, and conserve soil-moisture. The seed-bed is ordinarily prepared by plowing 6 to 8 inches deep in the late fall or early spring and pulverized just before planting by use of disk and harrow.

In both money and feeding value corn exceeds any other crop in Pennsylvania. It is grown chiefly in a rotation of corn, oats, wheat, and hay one or two years, or in a rotation of corn, oats, and hay for two or three years, although it finds a place in several

minor rotations. Corn usually follows sod and is generally fertilized with barnyard manure reinforced with acid phosphate. Six to eight loads of manure and 250 pounds of acid phosphate to the acre is a good treatment. The classes grown are yellow dent, white dent, white cap yellow dent, and flint. Flint is raised chiefly in the northern counties and higher elevations because it matures early. White cap yellow dent has a wide distribution and is generally the next earliest class. Yellow dent also has a wide range of distribution, while the white corn is the latest and is mostly grown in the southeastern part of the State. There are a number of varieties in each class. Improved Leaming, Cloud's Yellow Dent, and Reid's Yellow Dent are among the leading yellow varieties. Johnston County and Boone County are the leading white varieties. Lancaster Sure Crop and West Branch White Cap are the most planted for silage, although both are grown for grain where the season is long enough for them to mature.

Corn is raised chiefly for feeding live-stock. It is most fully utilized when made into silage. The 159,675 acres of silage crops not reported in Appendix H are nearly all corn; this should be added to the acres of corn reported as the first item in the table and would make 1,500,000 acres, more than 10 per cent of which is made into ensilage. More than half the acreage is cut and shocked in the field. Later it is husked and the stover fed to live-stock as roughage. The remainder of the crop is husked

and the stalks left standing in the field to be pastured later by live-stock.

During recent years variety tests of corn have been conducted in many parts of the State under the direction of The Pennsylvania State College to ascertain what varieties are best suited to local soil and climatic conditions. The average yield of corn is above that of any of the leading corn states of the Central West.

The feeding and energy value of an acre of corn and also its market value is much above that of hay or any of the other cereals adapted to Pennsylvania. For this reason the acreage of corn in the best corn counties has generally increased, while in the poor counties there has been quite a marked decrease. Some of the largest corn-producing counties have a small surplus to sell in the best years, but Pennsylvania as a whole does not produce enough to meet the demand for an adequate proportion of corn in concentrates normally required for live-stock. The leading corn counties in order of acreage in 1920 were Lancaster, York, Berks, Franklin, Chester, Bucks, Cumberland, Adams, Montgomery, and Westmoreland. Fig. 18 shows the distribution of this important crop by counties. The size of the black areas are in proportion to the acreage of corn in each county and represent the average acreage for the three years 1917-18 and 1919 as reported by the State Department of Agriculture.

Oats usually follow corn in the rotation. This crop is not so extensively grown in the better coun-

ties where corn is frequently followed by corn, potatoes, or wheat. Oats are the third cereal in point of acreage and value. The crop is of low money value an acre, but is extensively grown because it fits the rotations and does not seriously compete with other crops for labor. Furthermore, the grain is

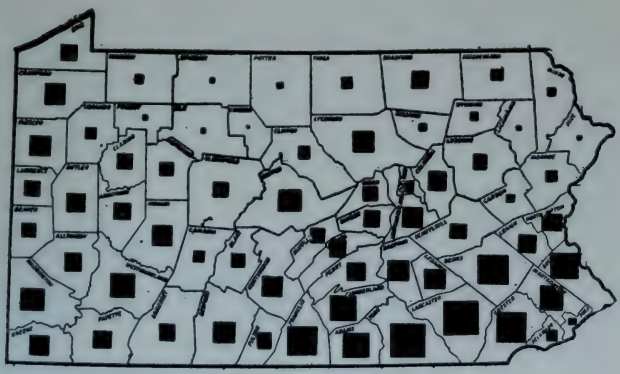

FIG. 18. Relative acreage of corn by counties. Average 1917-18 and 1919 as reported by the State Department of Agriculture.

in demand for horse feed and chop and the straw makes excellent bedding for live-stock. The early and medium maturing varieties usually succeed best and the seed should be sown as early in the spring as possible to obtain best results. When the preceding crop has been fertilized, no fertilizer is needed for oats. The acreage of oats was largest in 1890. The decrease in acreage since then has been due

chiefly to the rapid reduction in the better agricultural counties in the southeastern part of the State. In those counties the increase in land values and the adaptation of the land to crops of larger acre value has caused a marked change in the relative acreage of the three leading cereals, corn, wheat,

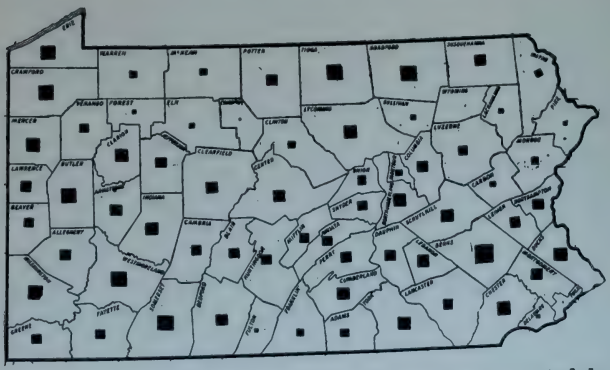

FIG. 19. Relative acreage of oats by counties reported by United States Census 1920.

and oats. Corn and wheat have been increased at the expense of oats. In seven of these counties, Adams, Bucks, Chester, Cumberland, Franklin, Lancaster, and York, there has been a decrease of nearly 100,000 acres in oats since 1890 and in the same period the acreage of corn and wheat together increased 137,000 acres. The leading oats counties are Berks, Bradford, Butler, Crawford, Erie, Mercer, Somerset, Tioga, Washington, and Westmore-

land. Fig. 19 shows the distribution of this crop by counties.

Wheat is the leading cash crop in the southern half of Pennsylvania. It ranks second among the cereals in both acreage and value. The grain is sold to the local flour mills, although some of it finds its way to the central markets. From the local mills the bran and shorts go back to the dairy farms of the immediate locality. Much of the flour is also utilized in the localities in which the wheat is grown. The straw is used for bedding.

Wheat usually follows oats in the rotation and is drilled on a finely pulverized and compact seedbed in the fall. The crop is generally fertilized with acid phosphate or a complete fertilizer at the rate of 150 to 300 pounds to the acre. In some cases the land receives barnyard manure in addition to the fertilizer. Four hundred to 500 pounds to the acre of a 2-12-4 are recommended. The figures refer to the percentage of nitrogen, phosphoric acid, and potash respectively contained in the fertilizer. In most cases grass (timothy) is sown with the wheat and red clover is seeded on the wheat early the next spring. The year following the wheat harvest the crop will be hay, in which red clover usually predominates. If allowed to remain for a second year, the hay will be mostly timothy. Red winter or soft winter wheat predominates, very little spring wheat being sown in the State. The latter is much inferior to the former in both quality and yield to the acre. The winter wheat varies in color from

white to amber and red. Less than 5 per cent of the wheat is white. The leading varieties are Fulcaster, Fultz, Mediterranean, Red Wave, and Pool. The date of seeding ranges from September 10 in elevated portions of the northern part of the State to October 5 in the southeastern part. In

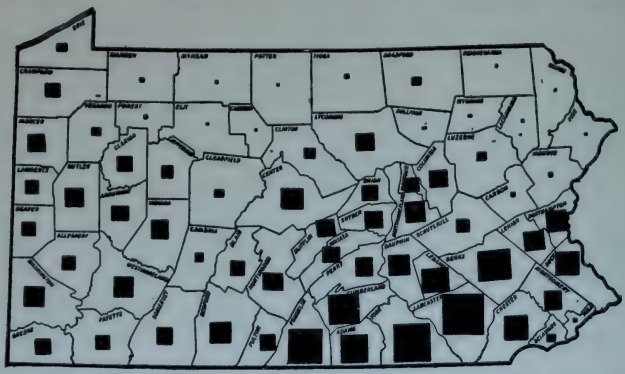

FIG. 20. Relative acreage of wheat by counties. Average 1917-18 and 1919 as reported by the State Department of Agriculture.

some years the Hessian fly is very bad and necessitates deferring the seeding date until near time for killing frosts.

Wheat harvest begins about July 1 in the southeastern part of Pennsylvania and continues until after the 15th, in the north. The grain is usually stored in the sheaf in barns and threshed at leisure in the fall and winter. The Angumois moth has become extremely bad in the southern part of the

State. It works in the stored sheaf grain as well as in the threshed grain. The prevalence of this pest threatens to change the method of storing the grain. It will now be better to thresh as early as possible and either market the grain at once or store in tight bins where it can be fumigated to destroy the moth.

The State Agricultural Experiment Station has developed and distributed a selection of Fulcaster wheat known as Pennsylvania 44 that has materially increased the yields of wheat wherever it is used. It is estimated that more than 50,000 acres in Pennsylvania were seeded to this wheat in the fall of 1922.

The principal wheat counties are Lancaster, York, Franklin, Berks, Adams, Cumberland, Chester, Westmoreland, Lebanon, and Washington. Fig. 20 shows the distribution of this crop in the State by counties, the black areas being in proportion to the acres grown in the years named.

Buckwheat ranks fourth in point of acreage and value. The acreage is sufficient, however, to place Pennsylvania in the first rank as a buckwheat state, New York being second. Buckwheat is a short-season crop and will mature seed in ten weeks from date of seeding. As cool weather favors seed development the crop is usually planted late in June or early July so the bulk of the seed will ripen just before killing frosts. It is adapted to poor soils, but responds to small applications of fertilizer high in phosphoric acid. Although buckwheat does best

when grown in a regular rotation, it has no very definite place in the crop rotation. Buckwheat is grown for flour, used for griddle cakes and for stock feed. During the four decades, 1880 to 1920, there has been very little change in the acreage. The counties leading in the production in 1920 are

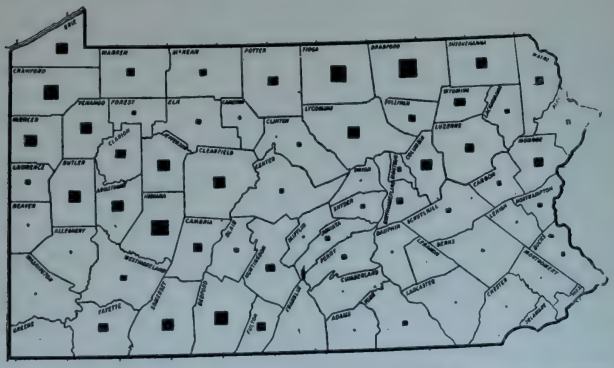

FIG. 21. Relative acreage of buckwheat by counties. Average 1917-18 and 1919 as reported by the State Department of Agriculture.

Bradford, Crawford, Indiana, Tioga, Erie, Jefferson, Butler, Bedford, Mercer, and Clearfield. Fig. 21 shows the relative acreage of this crop by counties.

Winter rye is the fifth cereal in point of importance, there being 243,000 acres in 1919, producing grain valued at $5,293,000. Prior to 1900 it was the fourth cereal in importance and outranked buckwheat in both acreage and total value. The acreage

was at its maximum in 1880, since when there has been a steady decrease, amounting to nearly 40 per cent in forty years. The grain is used for flour and for feed. Rye, like buckwheat, is tolerant to soil acidity. It is hardy, may be seeded late in the fall, and is adapted to poor and light soils. The yield to the acre is low, being only 13.2 bushels in 1920. There is considerable demand for the straw for packing purposes. The counties having the largest acreage of rye in order of importance are Berks, Franklin, Bucks, Northampton, Indiana, Bedford, Lehigh, Schuylkill, Montgomery, and Monroe.

Barley is of minor importance, there being only 13,785 acres in 1919, the grain of which was valued at $379,677. In Pennsylvania it is a spring-sown grain with soil and cultural requirements similar to those for oats. It demands a well-prepared seed-bed and should be seeded in the spring as soon as all danger of freezing is past. Best results are secured by drilling at the rate of six to eight pecks to the acre. All of the barley grown in Pennsylvania is used for feed. It weighs 48 pounds a bushel and the average yield of 19 bushels to the acre would, therefore, produce 912 pounds of grain as compared with the average production of 793 pounds of oats for the same year. The feeding value pound for pound is equal to that of oats, although the straw is less desirable. The counties leading in barley production are Tioga, Center, Erie, and Bradford.

HAY

The climate of Pennsylvania is adapted to the production of grass, and therefore a large acreage is devoted to hay and pasture. Including all tame hay crops there were 2,865,135 acres in 1919 producing 3,454,641 tons of hay valued at $92,992,640, or an average value of $32.50 an acre. The distribution of the hay acreage is as follows:

Timothy alone	971,941 acres
Timothy and clover	1,694,388 "
Clover alone	81,735 "
Alfalfa	30,773 "
Other tame grasses	86,298 "

About one-half of the acreage is seeded with winter wheat or rye, the timothy being sown with the grain in the fall and the clover on the grain early in the spring. The other half is seeded with spring grain, oats or barley, and both timothy and clover are then sown at time of planting the grain. The seedings are cut for hay from one to as many as six years. A large part of the hay fields, however, remains for only one and two years. The acreage of pasture is not reported in the 1920 Census, but in 1910 it was 4,350,126 as given in Bulletin No. 626, Office of Farm Management of the United States Department of Agriculture.

The counties leading in extent of all kinds of pasture in order of their acreage are Crawford, Washington, Greene, Bradford, Susquehanna, Erie,

Tioga, Somerset, Wayne, and Westmoreland. The range in acreage is from 137,044 from the last-named county to 230,558 acres for Crawford. Washington and Greene, with second and third places, are the two counties ranking highest in numbers of sheep.

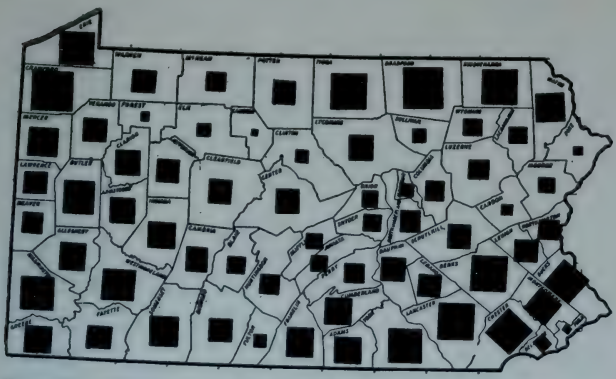

FIG. 22. Relative acreage of hay by counties. Average 1917-18 and 1919 as reported by the State Department of Agriculture.

Alfalfa is a new hay crop for Pennsylvania and the acreage increased from 52 in 1900 to 30,773 in 1920. It is a perennial legume, adapted to well-drained soils that are in good fertility and well supplied with lime. Alfalfa is rich in protein and makes a very valuable hay for all classes of stock, especially dairy cows and young animals. It yields nearly twice as much as red clover.

In the northern tier of counties and a number

immediately adjacent to them, the acreage and value of hay exceeds that of all the cereals. In many of these counties there are 1.5 acres of hay for each animal unit, while the State as a whole has only 1.1 acres to an animal unit.

The counties having more than 75,000 acres of hay in order of their acreage are: Bradford, Crawford, Tioga, Lancaster, Erie, York, Susquehanna, Berks, Washington, Westmoreland, and Bucks. Fig. 22 shows the distribution of hay in the State.

POTATOES

This cash crop is of increasing importance, the area devoted to potatoes having increased 79,000 acres or 43 per cent from 1880 to 1910 since which time it has declined. The small acreage in 1920 was due chiefly to a shortage of farm labor during that year. The labor requirements for potatoes are much higher than for the other general farm crops. The acreage for 1920 was 27.8 per cent more than in 1880. In the same period the population of the State increased 119 per cent. The increase in acreage of potatoes has not been equal to the growth in population; neither is the supply equal to the consumption of potatoes in Pennsylvania. There is an opportunity to increase the acreage or greatly augment the yield to the acre without overstocking the home markets. Recent tests with good varieties, the use of disease-free seed, and careful spraying of the vines to control early and late blight and the potato

beetle indicate that the average yield to the acre, now less than 100 bushels, could be doubled. In the last three years there has been much progress in methods of growing and marketing potatoes in Pennsylvania. Prior to that time very little attention had been given to kind and quality of seed and the very large percentage of the crop affected with diseases such as early and late blight, tip-burn, leaf-roll, fusarium wilt and rhizoctonia. At present methods of control for most of these troubles have been worked out, the application of which will greatly increase the yield and improve the quality of potatoes.

The grading of potatoes for market and the adoption of a standard package is also growing in favor and will do much to improve the reputation of Pennsylvania potatoes and increase the price to the producer.

The leading varieties are Rural, Petoskey, Green Mountain for medium and late crop, and Irish Cobbler and Triumph for early. The tendency is toward a limited number of standard varieties rather than the many sorts formerly grown.

In the years 1915 to 1919, inclusive, Pennsylvania ranked fifth in acres of potatoes but the average yield was only 82.8 bushels to the acre. For the same years Maine led all the states with an average yield of 184.7 bushels. In 1922 and 1923 yields of 400 bushels to the acre were reported in several Pennsylvania counties. The leading potato counties in order of their acreages are Lehigh, York, Lancaster, Berks,

and Chester. Other counties, such as Potter, Tioga, Somerset, and Cambria, are well adapted to the crop, and the growing of potatoes is becoming more important. Fig. 23 shows the relative acreage by counties.

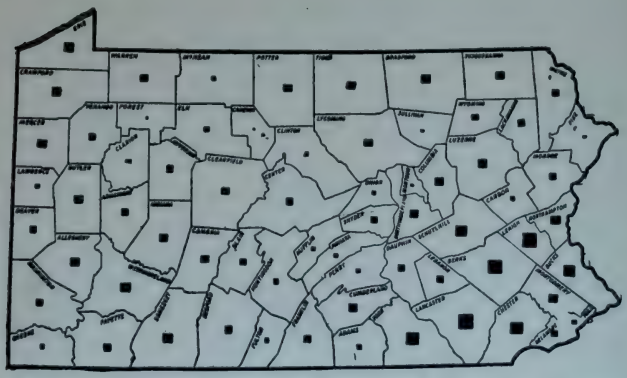

FIG. 23. Relative acreage of potatoes by counties. Average 1917-18 and 1919 as reported by the State Department of Agriculture.

FRUITS

Pennsylvania ranks high in tree-fruits, apples predominating. In 1920 there were 17,581,632 fruit-trees of all kinds and ages in the State, 9,616,647 being apples. Adams County leads in apples and is the center of the most important apple district of Pennsylvania. Other important apple counties in that section are York, Franklin, Bedford, Berks, Lancaster, and Cumberland. The leading varieties

in that locality are Stayman Winesap, York Imperial, and Rome Beauty for winter, Wealthy and Grimes for fall, and Summer Rambo and Williams Red for summer. Another apple district of importance includes Westmoreland, Allegheny, Washington, Mercer, Indiana, and Butler counties in the west end of the State. Erie County also ranks high in apples and stands first in the production of grapes. The leading varieties of apples in this district are the Baldwin and Stark. Another apple district of less importance is in the hard coal region with Luzerne and Schuylkill counties as the center. The leading varieties are Baldwin and Stark.

Census figures of the numbers of apple trees were not available for 1880. From 1890 to 1920 there has been no marked change in the number, the increase in some localities having been neutralized by a reduction in many sections less favorable to orcharding. The newer and more promising apple region of Pennsylvania is the one first above mentioned, with Adams County as the center. In Adams County there has been a 400 per cent increase in the number of trees in thirty years, while in the other counties mentioned in that district the increase in number of trees during the same period ranges from 35 to 135 per cent. In the west end of the State, on the contrary, there has been a reduction in number of trees in each of the counties mentioned, including Erie. The decrease for the seven counties named aggregates nearly a half million trees. Luzerne and Schuylkill counties both show consid-

erable increase in number of trees, as do also most of the adjoining counties.

The soils and climate in Pennsylvania are in general well adapted to the production of apples. The plantings of seventy-five and one hundred years ago were numerous but usually in small orchards. The absence of much definite knowledge about insects and diseases common to apples made crops of good quality more uncertain than at present. Recent investigations in this and near-by states have established new truths and principles relating to the business that has placed it on a scientific basis and large commercial orchards are more numerous than formerly, while the small orchards of one to five acres are probably less common.

Successful orcharding must take into account a number of factors, such as soil, elevation, topography, and both soil and air drainage. The exposure or air drainage is important in relation to spring frost injury and sometimes to the freezing of trees in the winter. Location with reference to markets and transportation must also be considered. No less important is the variety adaptation. The Stayman Winesap is especially suited to the southeastern and southern parts of the State and to elevations usually not exceeding 1200 feet. The York Imperial is also adapted to the southern section. The Baldwin and Northern Spy are better grown in northeastern Pennsylvania and in like manner other varieties are found to be best adapted to certain localities. Varieties are also related to soil type and do best

on certain soils. H. J. Wilder of the United States Department of Agriculture has made a special study of this relationship and his report may be found in the Annual Report of The Pennsylvania State College for 1910-11.

More recently the Pennsylvania State Department of Agriculture has made a survey of "The Apple Industry of Pennsylvania" reported in General Bulletin No. 369. The Pennsylvania State College Agricultural Experiment Station has conducted extensive fertilizer experiments on both old and young orchards, at various points in the State, and the results are reported in several bulletins of the Experiment Station.

Peaches rank next to apples in importance and in many places are grown as a filler in apple orchards. Severe winters have driven the peach out of most of northeastern and central Pennsylvania and it is most extensively grown in the southern and southeastern parts of the State and also quite successfully in the southwest.

Pears, once grown in considerable quantities, have declined and very few young pear orchards are now found.

Outside of Erie County very few plums and grapes are raised. There the grapes are extensively grown on the Dunkirk soils bordering Lake Erie. Cherries are confined chiefly to a few trees in home orchards well distributed over the State.

Small-fruits consist chiefly of strawberries, raspberries, blackberries and dewberries, with 4,008,

2,770, and 1,476 acres respectively. The total area of small-fruits reported in the 1920 Census was 8,680 acres as compared with 8,678 acres in 1910 and 12,271 acres in 1900. The counties leading in small-fruits in order of acreage reported in 1920 are Erie, Allegheny, York, Westmoreland, Lancaster, Berks, Mercer, Crawford, Beaver, Chester, Luzerne, and Greene. There is an opportunity for considerable expansion in small-fruit production, for the supply is far short of local demands.

VEGETABLES

The census for 1920 reports 54,283 acres of vegetables in Pennsylvania grown for sale only. This is exclusive of white potatoes, sweet potatoes and yams, and does not include the farm gardens. The total value of market vegetables was $8,857,017 or $163 an acre. The acreage of farm gardens is not reported. Of all farms 90 per cent reported home gardens and the aggregate value of products from these was $16,989,459 or an average value $93.34 a farm. This item is of considerable importance as a contribution to the farmers' living. The method of collecting statistics on vegetables for preceding census periods has been so different that comparisons are of very little value.

The leading market-gardening or truck-farming centers in Pennsylvania are in the vicinity of Philadelphia, Wilkes-Barre, Pittsburgh, and Erie. A second group includes Harrisburg, Johnstown, Al-

toona, Allentown, Sunbury, and Williamsport as centers. Outside of the above centers most of the market-garden vegetables are produced on a small scale and on general farms as a part of the cash crops. Scranton, Pittsville, and Hazleton are centers of this type.

The counties leading in acres of vegetables in order of importance are Allegheny, York, Bucks, Luzerne, Montgomery, Philadelphia, Lancaster, Adams, Erie, Schuylkill, Delaware, Chester, and Berks. With the exception of Adams a large urban population is in or near all of these counties. In 1919 they produced two-thirds of all the vegetables in the State grown for market.

The truck crops in order of their importance are cabbage, tomatoes, and sweet corn. In York, Adams, and Franklin counties the canning industry is well developed and creates a large demand for tomatoes and sweet corn. There is also considerable canning in Erie and Luzerne counties. The next most important truck crop is celery, rather extensively grown in the vicinity of Philadelphia. In Tioga County considerable areas of muck soil are now being used for celery and lettuce. In Crawford County are similar areas on which onions are grown. The Susquehanna and Wayne County muck areas are also being developed for celery and onions. All these muck soils are in the glaciated portion of the State and consist of numerous small areas.

Beans, peas, beets, and carrots are grown in a limited way in many localities.

The supply of truck crops grown in Pennsylvania is not sufficient to meet the demand of the population.

SPECIAL CROPS

Tobacco is very exacting in soil requirements and fertilization and calls for much skill and experience in its production, curing, and marketing. According to the 1920 Census, Lancaster County led with the production of 37,301 acres and York followed with 3,432 acres. These two counties produced 85 per cent of the entire acreage of the State. In no other county did the acreage exceed 800 and in forty-six of the sixty-seven counties no tobacco was reported.

Tobacco is a native of America and was not known or used in the Old World until it was introduced from North America during the early period of colonization. The development of commercial tobacco production in the Jamestown colony is familiar to all. The colonists brought over by Penn in 1682 gave much attention to its culture and, it is said, in 1689 shipped fourteen cargoes of the leaf from Philadelphia. Lancaster and York counties are probably centers of the earliest attempts at commercial tobacco culture in Pennsylvania. It is reported that tobacco was grown as early as 1828 by a few farmers near Ephrata. In 1839 there were in Lancaster County thirty to forty acres. Other counties in which the culture of tobacco dates back to 1850 or earlier are Clinton, Lycoming, Bradford, and Tioga.

In all of these the crop was grown principally on the bottom lands. According to the United States Census reports of 1840 and 1850, York County took first rank in production of tobacco in Pennsylvania but Lancaster County took the lead in 1860 and has held it ever since.

Lancaster, York, and Lycoming counties have for a number of years been favored with tobacco growers' associations and have been instrumental in fostering considerable experimental work with tobacco. The average yield of cured leaf tobacco to the acre ranges from 1,075 pounds in poor years to 1,500 in good seasons. Pennsylvania tobacco is chiefly of the Broadleaf type and it is typically a cigar filler product, although considerable is produced that is used for binders and wrappers.

Although tobacco requires good soil, plenty of manure and fertilizer and much labor, it is a profitable cash crop. According to the last census the average value an acre was $235.

Other crops, such as emmer and spelt, kafir and milo, mixed crops, beans and peas, flax, sorghum, broom-corn, sweet potatoes, vegetables, and miscellaneous hay and forage aggregate 107,907 acres valued at $10,711,395. Crops for which the acreage is not reported, such as fruits and nuts, farm gardens, sugar and sirup, and grass, clover and millet cut for seed, had an aggregate value of $40,463,843. To this should be added $9,297,035, the estimated value of corn stover from that portion of the crop that was cut and shocked. The changes in areas are

usually local and are manifest by studying the statistics by counties.

Appendix F, in which the counties are arranged in order of their agricultural rank, gives the status for each of ten general field crops, and also that based on the acres of the ten crops combined. The agricultural rank is founded on total acres of field crops plus the total animal units and is followed closely by the status based on the total acres of the ten general farm crops. The rank for the single crop is variable and frequently varies greatly from that based on acreage of all crops. Lancaster County, first in agricultural status and in that based on acres of the ten principal field crops, is also first in corn, wheat and tobacco, third in potatoes, and fourth in hay. These are the five leading crops of Lancaster County, while buckwheat, rye, barley, and oats are relatively unimportant. In Bradford County, sixth in agricultural rank, and with important dairy interests, hay, buckwheat, and oats are the important crops, while corn and wheat, in which Lancaster County excelled, are unimportant.

The raising of mushrooms is a special industry, the development of which has taken place chiefly since 1900. Delaware County and the southeastern part of Chester County in Pennsylvania are the largest mushroom-producing districts in the United States, more than three-fourths of the total output being in that locality. The uncertainty of the business was eliminated when B. M. Duggar discovered the "tissue method" of manufacturing spawn in

Plate V. Above, thousands of farmers in Pennsylvania keep at least a small flock of sheep. Below, numerous woodlots and shade trees are found throughout the State, especially on lands used for pasturing.

1902. From that date the industry has developed rapidly.

Since scientific methods have displaced chance in mushroom production, most of the crop is now grown in houses that permit of easy control of temperature, moisture, and ventilation. The hot water heating system has been most desirable and is used by most large growers. The houses are generally of inexpensive construction but the walls are usually built with an air space to aid in keeping an even temperature. The beds in which the mushrooms are grown are flat, 8 inches deep and 6 feet wide, built in tiers of shelves five or six beds to the tier. The beds are filled with horse manure that has been carefully composted for four or five weeks before placing in the beds. When the beds are filled the house is closed and in a day or two the temperature rises, sometimes to 120 degrees F., then slowly drops to normal. When the temperature falls to 70 degrees, the spawn is placed at frequent intervals over the beds about one inch below the surface of the manure. Two weeks after spawning the beds are covered with a layer of sifted loam one to one and a half inches deep. This is called "casing the beds." After this the temperature of the house is kept as nearly 56 degrees F. as possible. Water is applied to the beds as a spray occasionally to prevent drying. A good yield is one and one-half pounds of mushrooms to each square foot of bed surface. Mushrooms retail at 35 cents to $1.00 a pound. A house 40 feet wide and 200 feet long with four tiers of beds each

six beds high will have 28,800 square feet of bed surface and produce 14 to 18 tons of mushrooms valued at from $10,000 to $18,000. The business is profitable and may be followed as a side line to general farming.

The most extensive production of mushrooms under one management is in Butler County. Here an abandoned coal mine has been converted into a mushroom cave and there are nearly 1,000,000 square feet of beds in operation.

THE GREENHOUSE INDUSTRY

The greenhouse industry in Pennsylvania is devoted principally to the production of winter vegetables, cut-flowers, and the propagation of plants. Census figures relative to the extent of the business are not available, but it is estimated that there are about fifty acres under glass devoted to growing of vegetables, and a considerably smaller area to flowers and plants.

The cost of greenhouses ranges from 75 cents a square foot for cheap construction to $2.00 a foot for the better class of houses, the average cost being about $1.25 a square foot of area covered. On this basis the investment in houses for vegetable production amounts to rather more than $2,500,000.

According to the last census, Pennsylvania ranked third in value of flowers and plants sold in 1919, the gross sales being valued at $8,227,000. The State stood fourth in square feet of glass and sec-

ond in number of establishments. (See Appendix J.)

Philadelphia and Pittsburgh are the two large flower-distributing cities. Philadelphia and adjoining counties compose the largest center of production, being the most important producing center of flowering plants in the United States. Pittsburgh ranks second although its output does not fully supply the western part of the State, for much of the material comes from Lancaster, Philadelphia, and points west. The Pittsburgh Cut Flower Company, with fifteen acres under glass, has one of the largest ranges of glass in the United States. Both Philadelphia and Pittsburgh supply cut-flowers outside of the State to distant points south.

Lancaster County produces large quantities of sweet peas. Other centers of production, mostly for local consumption, are Wilkes-Barre, Scranton, Reading, Harrisburg, Erie, Altoona, Johnstown, York, and Washington.

Fashions in flowers, like that of dress, change from period to period. At present roses are most in demand. Carnations, sweet peas, and chrysanthemums follow in the order named. The season of largest demand is during the winter months from November to June inclusive, with high points on holidays such as Thanksgiving, Christmas, New Year's, and Easter.

The leading vegetable crops are lettuce, tomatoes, and cucumbers. In addition to greenhouses, one hundred thousand sash covering over a million and

three-quarters square feet of soil are used in the State for the production of plants and vegetables to maturity. Many florists' establishments, also, make a practice of growing vegetable plants in the spring for sale to commercial and home gardeners. According to the 1920 census, Pennsylvania ranks third in the receipts from the sale of vegetables and plants, with total returns of $1,720,631. Ohio led in this respect with Massachusetts second. Considerable space in special houses and cellars is devoted to the production of rhubarb and French endive. The mushroom industry contains more than four million square feet of actual bed space, with an output running into millions of pounds annually.

There are four main vegetable forcing centers in Pennsylvania: Erie, New Castle, and Kennett Square for greenhouses, and Philadelphia as a frame forcing center. Erie alone has nearly nine acres under glass. Other greenhouses are scattered throughout the State, chiefly near the larger cities as Pittsburgh, Altoona, Johnstown, and Wilkes-Barre. Mushrooms are grown chiefly in Chester and Butler counties. The largest French endive forcing establishments in the East are in Bradford County, while the only commercial melon range of importance in the United States is at Wales Junction, Montgomery County.

CHAPTER VII

ANIMAL INDUSTRIES OF PENNSYLVANIA

THE total value of live-stock on Pennsylvania farms in January, 1920, exclusive of poultry, was $219,420,538 or a little more than half that of all crops for the same period of time. Dairy cattle lead in numbers and value and are followed by horses and swine. Mules surpass in value a head and horses and dairy cattle come second and third. If only milk cows two years old and over are considered, the average value a head is $96.79.

The number of animal units reached its maximum in 1900, the same year that the acreage of all crops also attained its height. Since 1900 there has been a decline in numbers of horses, dairy cows, other cattle, and sheep. Swine have held their own, while mules and poultry have increased in numbers. In total animal units there has been a reduction of over a half million or 15 per cent since 1900. The reduction in horses is partly compensated for by the marked increase in number of mules. The number of horses and mules combined reached its maximum in 1890, since when there has been a reduction of

about 87,000 head. There has been no marked change in the number of milk cows for forty years. The character of dairy products has changed greatly. Market milk has increased and the manufacture of butter and cheese has decreased.

There has been a perceptible reduction in cattle other than dairy cows, especially since 1900. The decrease in sheep has been most marked, there being in 1920 less than one-third as many as forty years earlier. The status of poultry and eggs produced shows a healthy growth. (See Appendices K and L.)

HORSES AND MULES

During the first half of the nineteenth century oxen were extensively employed in Pennsylvania for farm work. Toward the last of the century they were replaced by horses, the replacement being nearly complete by 1900. From 1915 to the present time there has been some substitution of tractors for horse power on farms. This is destined to become more pronounced in the near future.

The 1920 census reports 505,966 horses of all ages valued at $60,828,872, or an average value of $120.22 a head, and 55,081 mules valued at $8,172,057, or an average of $146.36 a head. The aggregate value of horses and mules is $69,000,929. The number of horses as compared with the 1910 census has decreased in sixty-one of the counties, the total decrease for the State being 43,790 head. During the same period the numbers of mules in-

creased in fifty-seven counties, the total increase for Pennsylvania being 11,358. This, together with the higher value placed on the mule, indicates his preference on the farm for motive power purposes. Half of the reduction in number of horses in the last decade is due to the 1920 census figures having been collected in January before the spring crop of colts was born, while those for the preceding census were obtained in April after many had been born. When horses and mules one year old and over are compared, the reduction in numbers is only 9,448 or little more than one-half that of the decrease in number of farms during the same period. This does not suggest any displacement of horses in Pennsylvania by farm tractors up to this time, although it seems likely this will occur in the next few years. There was on farms in 1920 one horse over two years of age for every 16.6 acres of all kinds of crops. This is quite sufficient to do the work effectively on Pennsylvania farms.

That horse breeding is not extensively practiced in the State is evidenced by the annual purchase of a considerable number of western horses and mules and the small number of colts reported by the census. The number of colts in 1920 was only 8 per cent of the mares two years old or over. The number of stallions is also small, there being only 3,122 in the State. The counties that lead in number of colts are Franklin, Westmoreland, Crawford, and Center. Though mules are raised to some extent in many counties, those leading in mule colts are York and Adams.

CATTLE

If calves, heifers, and bulls are included, the number of dairy cattle reported by the census of 1920 is $1,315,803 valued at $106,676,549, or an average of $81.08 a head. The value of dairy products as reported by the same census was $99,617,373. This represents the total farm value, excluding milk and cream consumed as such on farms where produced. Seventy-three per cent of the sales are as fluid milk. Sales of breeding stock and veal calves are not reported.

The leading dairy breeds in order of numbers are: Holstein, Guernsey, Jersey, and Ayrshire. The Holsteins are the largest of the breeds and produce the most milk but the lowest in butter-fat. The Jerseys are the smallest and yield the smallest amount of milk, but the highest in butter-fat. There is a slow but gradual increase in the percentage of pure-bred dairy stock in all of the breeds and an increase in the grade of many herds by the use of pure-bred sires.

Cow-testing associations have rapidly increased in recent years and have been the principal factor in increasing the yield of milk for each cow. A record of the production of each individual in the herd soon indicates the profitable and unprofitable ones and enables the dairyman to know which cows to dispose of and which to breed from.

Calves from dairy cows are sold largely for veal.

Nearly all the male and about two-thirds of the heifer calves are sold to butchers at five to eight weeks of age. One-third of the heifer calves are raised to keep up the herds. These are from the best cows and sires and are playing an important rôle in building up the production of dairy herds in all parts

FIG. 24. Relative number of milk cows by counties. Average of 1917-18 and 1919 as determined by the State Department of Agriculture.

of the State. In reference to the sale of market milk, Chester County leads by selling 92.4 per cent of the total product as such, while the average for the State is 71 per cent, and the minimum 14.2 per cent is for Armstrong County. The dairy herds are responsible for a large part of the expense for purchased feeds which amounted to $51,678,000 during the year of 1919.

The counties leading in numbers of dairy cattle

in order of importance are Bradford, Lancaster, Chester, Crawford, Susquehanna, Erie, Tioga, and York, each of which has more than 40,000 head. Fig. 24 shows the distribution of milk cows by counties.

Beef cattle are not so important when the State as a whole is considered, there being only 229,745 head of all ages, the aggregate value being $16,389,-069. The counties leading in numbers of beef cattle are Lancaster, Greene, Somerset, York, Adams, Washington, Berks, Mercer, Franklin, and Westmoreland. These ten counties contain 115,464 or more than half of all the beef cattle in the State. Lancaster leads with 32,862, many of which come from the West as feeders, to be fattened in the county.

Of all the beef cattle in Pennsylvania it is estimated that 5 to 6 per cent are pure-bred. This is somewhat above the percentage for the whole United States. The Shorthorns lead in number, with Herefords a close second, Polled Angus third and Galloways fourth. There are only a few Galloways, while Pennsylvania possesses probably 1,000 head of Herefords.

Most of the steers fattened in Lancaster County are shipped to New York. Only about 10 per cent are raised in Pennsylvania, the remaining 90 per cent of feeders coming from other states, and Canada.

Appendix K reports the number of other cattle by decades. This includes all dairy bulls and all calves

and heifers of dairy breeds that are under two years of age, as well as all beef cattle. The number of cattle other than dairy cows reached the maximum in 1900. In the next ten years it was decreased to 652,879, a reduction of 32 per cent. Fig. 25 shows

FIG. 25. Relative number of cattle by counties. Average of 1917-18 and 1919 as determined by the State Department of Agriculture.

the distribution of all cattle other than dairy cows two years old and over by counties.

SWINE

Third in point of value and also in number of animal units are swine. There were in Pennsylvania in 1920, 1,190,951 swine of all ages valued at $22,111,277, or an average of $18.60 a head. There

has been no marked change in the number of swine for forty years. Since corn is the universal hog feed, those counties ranking highest in the production of corn also hold highest rank in numbers of swine. The first ten counties in corn production are also the first ten in numbers of swine. These are,

FIG. 26. Relative number of swine by counties. Average of 1917-18 and 1919 as determined by the State Department of Agriculture.

in order of importance, Lancaster, York, Berks, Franklin, Bucks, Montgomery, Cumberland, Chester, Adams, and Westmoreland.

Of all the swine in the State about 3 per cent are pure-bred. The Berkshires lead with about 12,000. Chester-Whites are second and number about 6000. Poland-Chinas and Durocs each have about 5500 and the Hampshires are last with about 2000.

The consumption of dressed pork by the population of Pennsylvania is about 84 pounds per capita and is, therefore, about three times as great as the production within the State. It is evident that about two-thirds of the pork comes from other states, principally those of the central western group. Fig. 26 shows the distribution of swine by counties. It is very much like the map for corn.

SHEEP AND GOATS

There has been a marked decline in the sheep industry in Pennsylvania in recent years. The number dropped from 1,531,066 in 1900 to 883,074 in 1910. In 1920 there were only 508,711 in the State, or one-third as many as in 1900. A part of the reduction in 1920 is due to census figures having been collected in January before the spring lambs were born. Making allowance for this, however, there is still a reduction of 128,830 head in the last decade. Only 9.4 per cent of the farms in the State reported sheep, as compared with 86.8 reporting cattle and 73.2 swine. Washington and Greene counties in the southwest corner are the two leading sheep counties. They are credited with over 240,000 head or 47.3 per cent of all the sheep in the State. Other counties having more than 10,000 sheep each in 1920 were, Mercer, Crawford, Bradford, Bedford, Tioga, and Franklin.

Of all the sheep in the State about 3.1 per cent are pure-bred. The number of sheep shorn in 1919 was 463,095, producing 3,227,414 pounds of wool

valued at $2,105,608, or an average of 7 pounds a fleece valued at $4.54.

In Greene and Washington counties the fine-wool sheep predominate, of which the Delaine-Merino is the principal breed. The individuals are much smaller than those of the long-wool or short-wool breeds but the fleeces average heavier than those of the larger sorts and the wool usually commands a premium of four to five cents a pound more than that of the other breeds. In 1919 the average value a fleece was $5.60 or over a dollar more than the average for the State.

The short-wool breeds are the least valuable for their wool but are prized for their mutton and production of lambs for market. The leading representatives of this class are the Hampshires and Shropshires. The Shropshires at twelve months of age have wool about three inches long. The rams weigh 200 to 250 pounds and the ewes 150 to 180 pounds. They are stylish sheep with a pronounced extension of wool over face and legs and rank high as a dual-purpose breed.

Next in point of numbers in the short-wool class are the Hampshires. This breed is less valuable for wool than the Shropshires, but the individuals mature early and average heavier. Rams at twelve months of age weigh 250 to 300 pounds and ewes 180 to 225 pounds.

Of the long-wool breed the Leicester and Cotswold predominate. The former is a large sheep, the rams at twelve months of age weighing 225 to 250 pounds

and the ewes 175 to 200 pounds. The wool at maturity is about 6 inches long. The Cotswold breed is heavier than the Leicester and the wool is about 8 inches long.

The sheep industry, more than any other animal enterprise on Pennsylvania's farms, has suffered a

FIG. 25. Relative number of cattle by counties. Average of 1917-18 and 1919 as determined by the State Department of Agriculture.

decline. The destruction of sheep by dogs and inadequate dog laws have done much to discourage the industry. There is room for a small flock of sheep on nearly every farm. They will utilize what would otherwise be wasted and can be kept at a very low cost. Fig. 27 shows where in the State most sheep are raised.

There were only 2578 goats on farms in Pennsylvania in 1920.

POULTRY

The poultry business is more important than any of the productive live-stock enterprises except dairy cattle. There were 15,226,961 head of poultry in Pennsylvania reported in the 1920 census valued at $18,639,535 or $1.22 a head. The eggs produced during the year were valued at $36,479,123, of which $26,107,333 were sold. Chickens raised were valued at $17,230,120, of which $7,447,234 were sold. The value of poultry products for the year, exclusive of the flocks, was $53,709,243, or an average of $285 for each of the farms reporting poultry.

The number of poultry in Pennsylvania has more than doubled in forty years, while the production of eggs has increased 130 per cent. The ten counties ranking highest in poultry are Lancaster, York, Berks, Bucks, Montgomery, Chester, Adams, Franklin, Bradford, and Westmoreland. Of these seven are in the first ten counties in agricultural rank. The 1920 census reported chickens on 93.3 per cent of the farms of the State. The average farm flock numbers about seventy-five chickens. There are about 1,000 farms in Pennsylvania on which the number of chickens exceed 500. These include farms devoted exclusively to poultry, but many of them are general farms on which poultry is one of the major enterprises.

The leading breeds of chickens in order of their importance are White Leghorns, Plymouth Rocks,

Rhode Island Reds, and Wyandottes. Ninety per cent of all the chickens in the State are Leghorns. While this is the smallest breed, it leads in the economical production of eggs. The eggs average as large as those of the bigger breeds, the weight a dozen for standard eggs from mature birds being 24 ounces. The Leghorns, because of small size, white skin, and tendency to remain thin, are the least desirable for meat. The Rhode Island Reds are an excellent dual breed, having all the characteristics desired for meat and at the same time being good egg-producers.

The numbers of turkeys, ducks, and geese in Pennsylvania are insignificant as compared to chickens. The total number of the three classes of fowls in 1920 was only 334,660. In spite of an average value of $4.89 a head for turkeys, the numbers since 1910 decreased 36 per cent. In 1920 guinea fowls numbered 188,600 and pigeons 200,000.

CHAPTER VIII

MARKETS AND MARKETING

The location of a producing area is a primary factor in determining the facility with which its products can be marketed. In this respect, Pennsylvania occupies a strategic position. New England, New York, New Jersey, and Pennsylvania have a combined land area little larger than that of California. This area, constituting roughly 5 per cent of the total of the United States, had 28 per cent of the total population in 1910. Considering the fact that consuming power is determined not only by the number of persons but also by their ability to buy what they want, there is no area of similar size in the world which is so great a market as these few eastern states.

Pennsylvania's location is strategic in another particular. It lies across the pathway of all but one of the land routes which connect the West and South with the great consuming and distributing centers of northeastern United States. It is traversed by such important carriers as the Pennsylvania, the New York Central, the Lehigh Valley, the

Delaware and Lackawanna, the Erie, the Philadelphia and Reading, the Baltimore and Ohio, and the Western Maryland Railroads. Its location also gives it access to foreign trade. Within its borders is Philadelphia, one of the gateways to the export markets, and within easy reach are two others, New York City and Baltimore. While Philadelphia affords an outlet to ocean routes, Erie gives it access to the Great Lakes. Not far from its borders are Washington, D. C., Baltimore, Maryland, Wilmington, Delaware, Trenton, New Jersey, Buffalo and Rochester, New York.

However, not all the good markets lie outside of the State. The fourteenth census credits Pennsylvania with a population of 8,720,017, making it the second most populous state of the Union. Its three great consuming districts are Philadelphia with its large suburban section in the southeastern part of the State, the steel and coke district centering in Pittsburgh at the western end, and the anthracite coal region centering in Scranton in the northeast. Fig. 28 shows the other local markets well scattered through the State.

Pennsylvania also has more local markets—industrial and mining towns—than any other state. There are more than 150 with a population of 5000 or over.

Certain of these points, due to their location and good transportation facilities, act as wholesale distributing centers for the territory in their sections. In them are located various wholesale receivers of

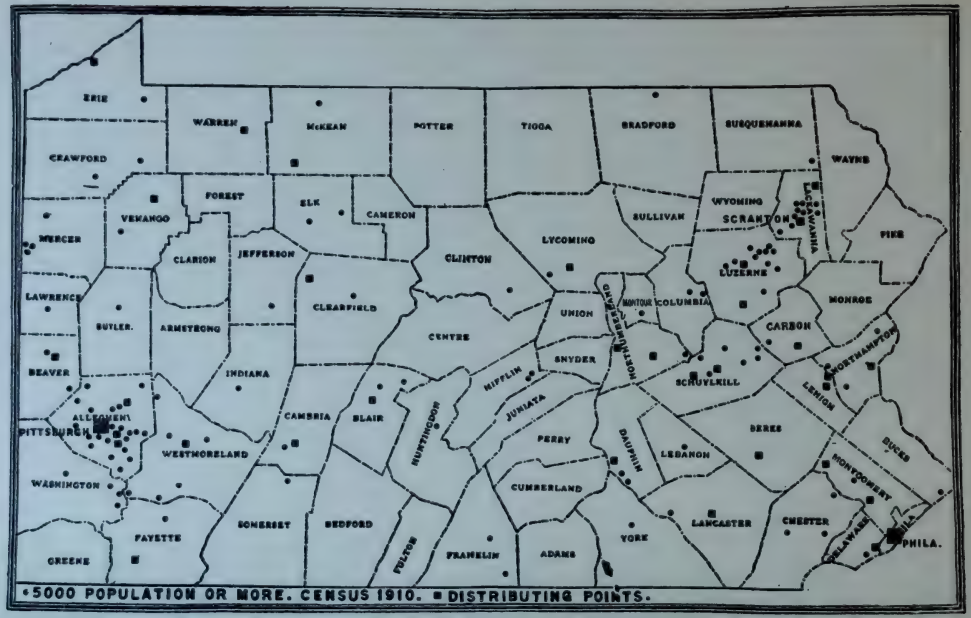

FIG. 28. Showing many of the most important markets of Pennsylvania.

farm products, such as commission-men, wholesale butter and egg dealers, and others. The large packing companies have also found these convenient points from which to distribute their products, and have there located their branch houses. In some instances they buy locally produced live-stock. Among these distributing markets Philadelphia and Pittsburgh stand out as two of the most important in the United States. In addition to being great railroad centers, their handling, storage, and other facilities have been developed on a large scale. Pittsburgh is a great gateway to and from the western end of the State, while Philadelphia acts in a similar capacity on the southeast, both for land and water routes.

TRANSPORTATION AND MARKETING

Attention has already been called to the fact that Pennsylvania is abundantly supplied with trunk lines of railroads running east and west. Their fast and frequent service is a great asset in marketing perishable products. North and south outlets have not been neglected. Much of the milk from the northern counties, where dairying is the chief agricultural industry, goes into markets in New York state by several lines of railroads crossing these counties north and south. Buffalo, Rochester, and other New York markets are thus within easy reach. While several of these lines in the eastern end of the State were built primarily to provide an outlet

for coal, they are equally convenient carriers of foodstuffs for the rapidly growing mining centers which they serve. This statement might also be applied to the western end. Pittsburgh is well connected with Ashtabula, Cleveland, Erie, Buffalo, and Rochester. It is hardly necessary to point out that growers and shippers of farm products are fortunate, indeed, to have such excellent railroad facilities. They are equally well served in shipments of the agricultural supplies which they require.

The eastern and western ends of the State have a large number of trolley lines radiating from all the principal markets. Most of these electric lines carry freight and express, but the coming of good roads and motor trucks has made serious inroads on their use for such purposes. However, the fact remains that they are available.

Too much emphasis cannot be laid on good roads as a factor in the economical marketing of farm products. Good roads and motor trucks greatly enlarge the area from which a city can draw its supply of fresh produce. Other factors being favorable, market-gardening becomes easily possible anywhere within a radius of thirty miles of the market. Many instances could be cited of more remote production than this, without the necessity of resorting to rail shipments. Pennsylvania is thoroughly covered with a network of State highways. In addition to these primary routes, hundreds of miles of good roads are maintained by counties and towns.

The value of these roads to the farmers is indi-

cated by the figures collected recently by the Bureau of Statistics of the Pennsylvania Department of Agriculture. According to this authority, there were 10,250 motor trucks on the farms of Pennsylvania on January 1, 1920. The significance of this is far-reaching. Many farms that were isolated before the advent of the motor truck and state roads are now within easy hauling distance of good markets. What influence these recent improvements in transportation facilities are having on the readjustment in producing areas is impossible to determine at present, but it can hardly be doubted that such readjustment is taking place.

In addition to the trucks, over 100,000 automobiles are owned by farmers. It is certain that a large number of these are used in part for business purposes. They make the contact between farm and market much more frequent than ever before. Frequency of contact with the market is a decidedly important item and the lack of it has always been a handicap to farmers. It is one of the reasons why they have been at a disadvantage in dealing with the buyers of their products. The buyer is in constant contact and, therefore, knows market conditions. The farmer's information was infrequent and incomplete and he was unable to know what his products were really worth. The man who gets to market only semi-occasionally is most likely to sell his products for less than they are worth. Being less familiar with market practices and the little things which indicate market conditions, he is handicapped in selling

to advantage. On the other hand, lack of information may cause him to set too high a price on his product with a consequent delay in making sales. This results in a loss of valuable time. The more he sees of the market the more intelligently will he be able to sell.

PUBLIC MARKETS

The present-day methods of distributing foodstuffs are regarded as highly complex, and so they are. They consist simply of collecting a great variety of products harvested particularly in the summer and fall from the 200,000 farms of Pennsylvania and placing them on the tables of the one and one-half million homes in the State at the times and in the quantities in which they are wanted from day to day the year round. The surplus must be exported to other markets where it is required, while the other needs of these one and one-half million homes must be met by bringing in products not only from other states but from all over the world. It is strange that any one should believe that any considerable part of this distributing work can be reduced to direct sales from producer to consumer. Nevertheless, in certain parts of Pennsylvania there exists an old established marketing method by which producers and consumers are brought together. It is the so-called "public market."

The public market is a distributing method which is obviously of local service only. There are at present 136 of these markets in Pennsylvania. Their

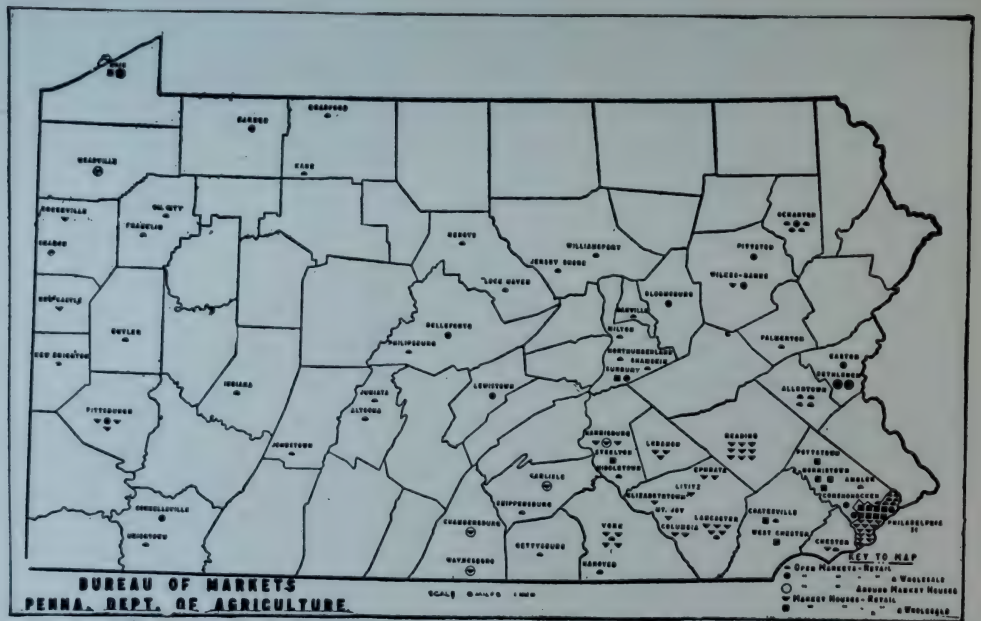

FIG. 29. Location and type of public markets of Pennsylvania.

locations are shown in Fig. 29. There are two general types, namely, "open markets" and "market-houses." The "open markets" are conducted in some cities in the street and are frequently called "curb" markets. Elsewhere they may be held on vacant lots at convenient or available points in the city. When the market is held in the street, the curb is usually marked off into spaces wide enough to back a truck or wagon into. In some cases, the city furnishes such spaces to growers without charge, while in other places the city makes a nominal charge to the farmer either by the day or month for the use of these "stands" from which to sell his products. There are thirty-five of the "open markets" in Pennsylvania cities. Obviously in bad weather no protection is afforded either to the buyers or to the products which are being sold. On the other hand, they provide a simple method of bringing producer and consumer together when such a method is desired. Cities rarely try to make any profit out of the fees charged for "stands," but rather make such fees large enough to cover the extra cost of some supervision and the cleaning of the streets. It is seldom that farmers consider the fees excessive.

The "market-houses" are chiefly in the cities of southeastern Pennsylvania, such as Harrisburg, York, Lancaster, Reading, and Philadelphia. Reading has nine of these markets in different parts of the city. Many of the market-houses are very old, some of them having been in existence for over a hundred years. The habit of going to market and

carrying home purchases in a basket has become firmly established among a large number of housewives, and on market days it is common to see both men and women on the street-cars with market-baskets loaded with farm produce. These "market-houses" are frequently referred to as "public" markets, though in reality this is a misnomer. Very few are owned by the municipalities, most of them being owned and operated by stock companies. The proceeds derived from the rentals of "stands" is sufficient in some instances to return a substantial dividend to the stockholders, while in other cases returns have been so meager that a few markets have been converted for other uses. The number of city market houses is not increasing very rapidly.

Most of the markets operate only on two or three days of the week. Different markets may be open on separate days, though in Harrisburg they all operate on Wednesday and Saturday. Their primary object is to provide a method of direct selling from producer to consumer. In only a few is wholesaling permitted. Harrisburg, Reading, Lancaster, and York have so-called "forestalling" ordinances designed to prevent producers from selling products to other persons for re-sale. The idea seems to be that if a product passes through the hands of an additional party the price is necessarily raised. Such an argument entirely overlooks the fact that wholesale prices are likely to be low enough to permit re-sale at normal retail prices. They also fail to recognize that farmers who sell their product in

large quantities at wholesale prices are relieved of the extra time and cost necessary to do retail selling. There is not much evidence that the prices in these markets are noticeably below those charged by regular retail dealers. Regulations of the kind mentioned tend to drive some produce to other markets and so deprive the city of as large a supply of produce as would otherwise be available to its people.

Many kinds of food products are sold in these markets. They are not confined to locally grown farm produce. In them are to be found fruits and vegetables of all kinds, fresh and smoked meats, live and dressed poultry, fish and oysters, dairy products and eggs, baked goods, candies, plants and cut-flowers.

The sanitary conditions of these markets could be greatly improved. In warm weather there is no adequate protection from dirt and flies and rarely are refrigeration facilities to be found at the stands where fresh meats are sold. However, these conditions could be easily remedied.

As a rule, the larger and more specialized growers do not attempt to sell in these markets, though there are some exceptions. Most farmers using this method for the sale of their products grow a great variety of fruits and vegetables so that they can carry a complete line of products on their stands. One is led to wonder whether this represents efficiency, as the successful growing of almost any one of these products requires a considerable degree of skill and technical knowledge.

STORAGE FACILITIES

In recent years, the high cost of living has led many to attack, among other phases of the system of distribution, that very valuable and necessary part, cold storage. The fact is that in Pennsylvania more rather than less cold storage facilities are needed. Most of the cities are inadequately equipped, although probably they are not suffering in this respect any more than are the large cities of other states the country over. The present attitude of the country does not furnish much encouragement to capital to build and equip expensive cold storage. An idea seems to be prevalent that cold storage is used chiefly for the purpose of hoarding great quantities of perishable food-stuffs in order to raise prices artificially to a point at which profits are enormous. This attitude cannot be too vigorously condemned. The business of buying eggs, butter, and other perishables during the spring and summer, and storing them for winter consumption is very risky. It frequently results in heavy losses instead of profits.

A recent study of egg marketing published by the New York State Division of Foods and Markets states as follows: "During the period between 1907 and 1914, for example, it (the profit) was only a fraction of one cent per dozen. During the period between 1914 and 1917, it was a little above one cent per dozen. It is obvious from the data given that

the business of storing eggs is extremely hazardous from a financial point of view. The shrewd dealer who stored eggs in the years 1908, 1911, 1913, and 1916 undoubtedly made very handsome profits. If he was unfortunate enough to store eggs only during the other years, he made no money at all but instead lost heavily. The average dealer, of course, probably had some eggs in storage during all these years so that in the long run he was able to balance the losses during the bad years by those (the profits?) in the more profitable ones."

Some of the more important fruit-growers of the State rent storage space for apples in the larger markets where most of their product is sold. At least one farmers' marketing association is equipped with a good cold storage plant of its own, used principally for the keeping of apples.

MARKETING METHODS AND INFORMATION

It is difficult to describe marketing methods in general terms, as they differ so widely in the same state due to varying conditions of production. As a rule, growers who have specialized in a limited number of crops are more efficient in marketing them than those who produce a great variety. Illustrations in Pennsylvania are to be found in the highly specialized market-gardening regions, as around Philadelphia, the apple and peach section in Adams County, the grape belt in Erie County, the potato district in eastern Pennsylvania, the tobacco section

centered in Lancaster, and in some instances in the dairy regions.

Many farmers have made a careful study of production problems, but a much smaller number has given the careful study to marketing problems that the situation demands. Reference has already been made to the infrequent contact with the market which often puts a farmer at a disadvantage in selling his products. He needs to know several things. While the one most generally thought of is the question of price, in reality the most important information is in regard to those conditions which affect the prices, that is to say, conditions of supply of the commodities one has to offer in market, and the existing demands for that product. The extremes of these conditions are gluts and great scarcity. The influence of either one on prices is too well understood to need discussion, but the farmer who does not know when and where these circumstances exist may put his products in the wrong markets. Most newspapers carry a certain amount of market information, but generally this is merely a statement of price quotations. They are well worth study, but need to be supplemented by other facts.

In 1922 the Bureau of Markets of the Pennsylvania Department of Agriculture inaugurated a system of marketing information which should be given a thorough trial. Market reporters have been stationed in the following cities: Lancaster, Allentown, Easton, Wilkes-Barre, Scranton, Harrisburg, York, Pittsburgh, and Erie. These men are furnishing regu-

lar reports to the local papers regarding fruits and vegetables, grains, and in Lancaster and Pittsburgh, live-stock. The information is not only a quotation of prevailing prices which are being paid to farmers, but indicates also conditions of supply and demand. Their work is supplemented by the United States Bureau of Markets, which has extended its telegraphic service to the office of the Pennsylvania Bureau of Markets at Harrisburg, where reports on the larger markets of the East, such as Pittsburgh, Philadelphia, and New York are received daily. Certain parts of this information on the larger markets will be found in the local Pennsylvania papers. Fig. 30 indicates the scope of this service.

There is much difference of opinion as to the value of grading farm products. A careful study, however, generally leads to the conclusion that grading is a necessary step toward successful marketing in commercial quantities. In this connection it is significant that practically every large and successful fruit-grower grades his fruit before offering it for sale. A trip around the markets often reveals a large quantity of perishable products in such a condition of deterioration or low grade that they are practically a total loss. It is a waste of time and money to send commodities to market in an unmerchantable condition. It is also the cause of much of the dissatisfaction between producers and dealers. The farmer may rest assured that in the end he cannot receive the price of a good product if he persists in including the worthless with the good.

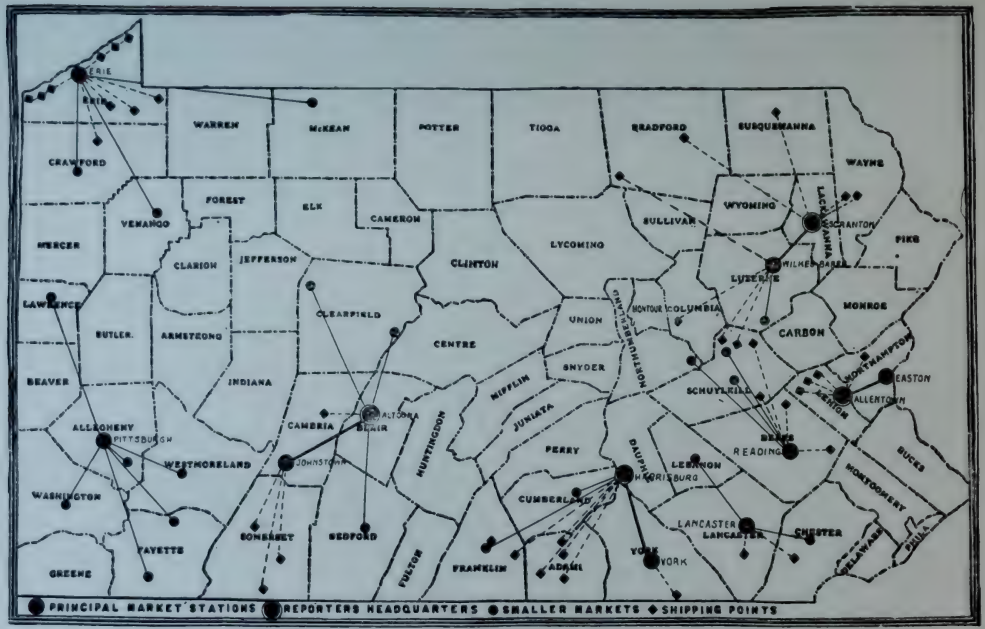

FIG. 30. The reporting stations of the Bureau of Markets.

There are probably times when the condition of the market scarcely makes it worth while to spend much time in grading, but these are exceptional instances.

The State has a law which requires apple-growers who ship in closed packages to stamp on the outside of the package the name of the grower and his address. It also requires that the face or shown surface shall fairly represent the contents. There is no definition of grades. The Secretary of Agriculture, who is authorized to promulgate grades for all farm produce, recently established standard grades for apples, corresponding to the United States Standard after the proposed grades had been given a preliminary trial by fruit-growers for several years.

In most of the important potato-growing sections of the State, it is customary to grade the crop. The grades recommended by the United States Bureau of Markets have proved satisfactory after having been experimented with for a year or two.

Wheat, hay, and wool grades might well receive more attention than has so far been given them, although something has been done along this line in some parts of Pennsylvania.

Closely related to grades is the question of containers. The average farmer has little appreciation of the large variety of sizes and shapes of containers which the consumer finds in the markets. There is a federal law which requires that a statement of the capacity of containers be conspicuously marked on the outside, but probably only a small percentage of the buying public know of the existence of such a law.

Following the federal regulations, the State department has established standard containers for Climax, and berry or till baskets. Certain standards for round stave baskets, market baskets and hampers are under consideration, but State action probably will await federal legislation on this subject. A bill to standardize fruit and vegetable packages is now before Congress. This problem is more important to producers than is sometimes assumed, because anything which makes the purchasing of fruit and vegetable products more satisfactory to the consumer should tend to improve their sale.

COÖPERATIVE ORGANIZATIONS

There has been a most remarkable growth in the last two or three years in the number of farmers' cooperative selling organizations in Pennsylvania. Associations exist for the marketing of fruit, potatoes, tobacco, wool, and dairy products. Perhaps the most outstanding are certain associations for the sale of tobacco in Lancaster County, potatoes in Cambria and Potter counties, fruit in Adams County, grapes in Erie County, and the handling of milk in seven cities, the ones at Greenville and Connellsville being the most conspicuous examples, and the collective sale of milk by the Inter-State Milk Producers' Association with headquarters at Philadelphia and the Dairymen's Coöperative Sales Company with headquarters at Pittsburgh.

The most apparent advantages to be obtained from

such organizations are the assembling of products in such quantities as to attract the best buyers, to facilitate grading and packing of the commodities handled, and to centralize the selling in the hands of one experienced man. It is important to keep in mind, however, that the last four or five years have been easy ones for these organizations to do a profitable business. There has been an almost steadily rising market, which has made success almost certain, even with only mediocre management, but now that the period of readjustment has begun, market conditions are more likely to fluctuate and prices decline. It will require higher standards of management to succeed under these conditions. Fig. 31 shows the number and location of farmers' business organizations in Pennsylvania. They total considerably over one hundred. The larger number are not strictly coöperative associations. Most of them are stock companies, but are more or less coöperative in spirit and operation. Probably there are more buying than selling organizations.

The Legislature of 1919 passed a law providing for the organization of coöperative associations without capital stock and not conducted for profit. This means simply that instead of raising their necessary capital by the sale of stock, it is done by issuing some kind of certificates of indebtedness which accomplish the same purpose. To say that they are not conducted for profit indicates merely that the main purpose of the organization is to provide a more satisfactory selling service to the members than they

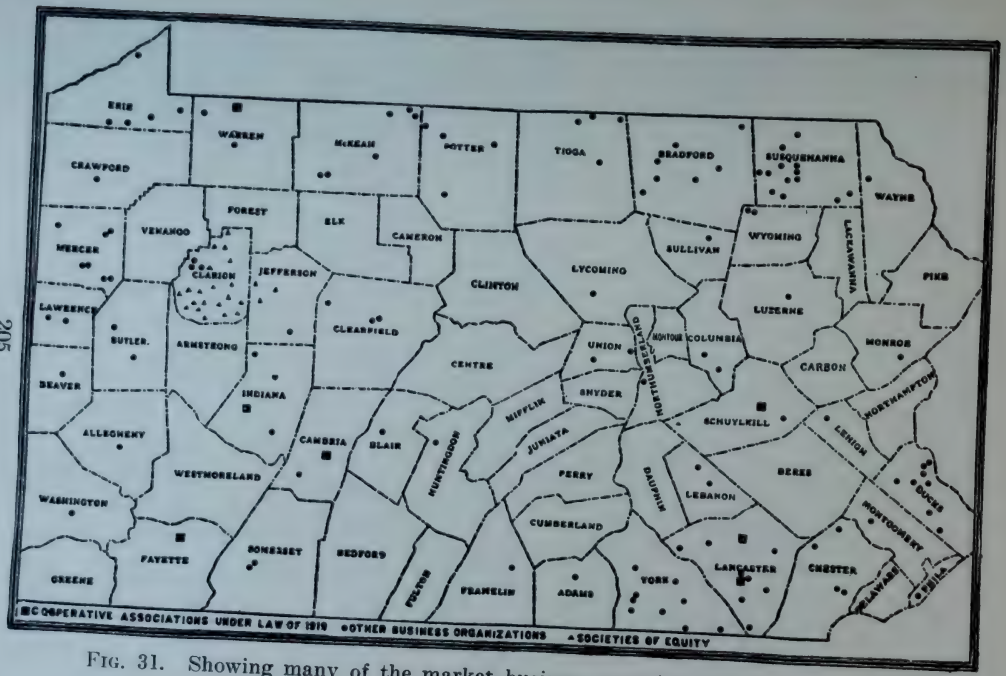

FIG. 31. Showing many of the market business organizations of Pennsylvania.

can obtain as individuals acting independently of each other. A regular rate of interest is generally paid on the money furnished by the members, but beyond this no dividends are declared. However, if surplus funds exist at the end of the year, they are divided among the members in proportion to the amount of business which each has done with the organization. Quite a number of associations have already been organized under this law.[1]

There is considerable complaint on the part of some farmers as to the treatment which they believe they have received at the hands of commission-men to whom they have consigned their products. Unquestionably a large part of these complaints are due to a lack of understanding of the proper precautions which should be taken in this method of marketing. It is difficult to understand why a producer would consign a shipment of his products to any firm about which he has no information, yet this is frequently done. It is possible to get from banks the rating of reputable firms, whether commission-men or buyers. Advance notice to the commission-men that a shipment is about to be made would also facilitate the handling of the business. In other words, every step should be taken to become acquainted with the parties with whom one is dealing, and an effort made to keep in close com-

[1] General Bull. No. 341 of the Penn. Dept. of Agr. entitled "Farmers' Co-operative Associations in Pennsylvania under the law of 1919" gives information regarding the steps to be taken in organizing under this law. It also includes suggested articles of association, by-laws, and other forms.

munication with them. If this were done, many of the unpleasant experiences would be avoided.

The farmer himself must solve his own marketing problems. No one is likely to take the same interest in them that he is. However, this does not mean that he cannot secure valuable suggestions and assistance. There are several agencies of fairly recent origin from which certain kinds of marketing information and guidance can be obtained for the asking.

A Department of Agricultural Economics recently established at the Pennsylvania State College is making extensive studies on all problems having a bearing on the marketing of farm products. The results from these as well as similar studies in other states are available to the farmers of Pennsylvania and are carried to them by publications, extension specialists in agricultural economics, and the press. The information studied and presented includes the basic economic principles underlying agriculture and its relation to industry, coöperative organizations of the types including buying, selling, grading, breeding, and the like, the various phases of agricultural finance as applied to individual and coöperative groups, and all other phases of marketing that are directly dependent on making satisfied consumers of Pennsylvania farm products.

The county agricultural agents, who are intimately acquainted with the local marketing problems and through whom the extension specialists gain entrance to the local community, render an

important service in helping to solve the problems of marketing.

In 1917 the Pennsylvania Legislature passed a law establishing a State Bureau of Markets. Due to certain imperfections, this law was supplanted by a new one in 1919. By this act the Bureau became a part of the State Department of Agriculture under the administration of the Secretary of Agriculture. Regarding its broad and rather general powers, the law states as follows:

"Section 1. Be it enacted, etc., That in order to promote efficient and economical methods of marketing farm products, the Bureau of Markets in the Department of Agriculture, under the direction of the Secretary of Agriculture, shall have power:

"(a) To investigate the subject of marketing farm products, including the costs of marketing, to publish the results of such investigations, and to furnish advice and assistance to the public with reference to the marketing of farm products within this Commonwealth and all matters relevant thereto.

"(b) To gather and diffuse timely information concerning the supply, demand, prevailing prices, and commercial movement of farm products, including quantities in common and cold storage.

"(c) To secure in the performance of the duties herein prescribed, the co-operation and assistance of all other agencies.

"(d) To assist and advise in the organization and conduct of public markets, of co-operative and other associations for improving marketing con-

ditions and activities among producers, distributors, and consumers.

"(e) To investigate delays, embargoes, conditions, practices, charges, and rates in the transportation and storage of all farm products, which appear to be detrimental to a free, economical, and efficient marketing of such products.

"(f) To take such lawful steps as may be deemed advisable to prevent waste of perishable products."

If these powers are wisely carried out, the Bureau should make its influence felt in the marketing affairs of the State. It can assist in many ways in the solution of the marketing problems of Pennsylvania farmers. It is to be hoped that political influences will be kept out in order that the Bureau may function unhampered.

In addition to the State marketing agencies, the United States Bureau of Markets has accumulated a great fund of marketing information which is available to anyone who asks for it. There is close cooperation between this Federal Bureau and the State Bureau of Markets and State College.

CHAPTER IX

RURAL MANUFACTURES OF PENNSYLVANIA

THE general decrease in farm manufacture is perhaps of more social than economic importance. A large number of products formerly manufactured on the farms are now made in large quantities in certain centers. A few plant and animal food products, however, are now made to a greater extent on the farms than they were a few years ago. From a social standpoint, there are no doubt many points in favor of neighborhood or community manufacture.

Pennsylvania is especially well situated to furnish a market for products manufactured on the farm. In the first place, the people have been accustomed to use farm-made goods, and secondly, because of the large number of small cities scattered throughout the State, there is a great demand for products of all kinds. A good example is furnished in a comparison of Pennsylvania with some of the newer states, as those in the Middle West. There, because the factories or creameries started about the same time that large quantities of milk began to be produced, people became accustomed to factory butter and now prefer it to the farm butter. In Pennsyl-

vania, however, farm-dairy butter is preferred by a great many to the factory-made product.

Local conditions determine whether it is profitable to make the various crops and products into manufactured articles. In districts remote from cities, where the skim-milk cannot be sold or fed to advantage, making it into one or more of the various kinds of skim cheeses will prove advantageous, while in the neighborhood of cities where skim-milk can be sold at a good price, it may not be profitable. In some parts of the State there are no factories conveniently located to receive the raw product. Two points of great economical importance must be considered in the making of products on the farm. One is the division of labor, and the other taking care of the surplus, or prevention of a glut on the market, and also to provide a means of preventing an article from coming onto the market in its raw form, when it could be manufactured into a more wholesome and desirable product. Every large and properly organized business establishment tries to have a uniform amount of work throughout the year. Every effort is made to employ about the same number of men each month. On the farm, however, too often all of the work is done in a few months. A system can be worked out on the farm that would give steady employment. From the late winter, or very early spring, when the maple sugar and sirup can be made, to the Christmas cheese or sausage-making time, profitable and saleable food products can be manufactured on the farm. These side lines

on many farms furnish a greater income than the regular products. This could be true on many more Pennsylvania farms.

The simple and economical gasoline engine and the general extension of electrical transmission lines have reduced the manual labor of rural manufacture. The butter is churned, the sausage ground, and the apple pulp squeezed by power machines. This makes it possible to produce articles more cheaply and to make them more uniform in quality.

More butter is manufactured on the farms of Pennsylvania than in any other state in the Union except Texas. In 1919 $21,137,718 worth was made. Whether it is profitable to make butter on the farm depends, of course, on the demand for the farm-manufactured product, and the location of the farms relative to a creamery. Many localities in the State are a long distance from the railroads, the dairies are small and scattered, and the only outlet is to sell the butter to a huckster or groceryman. Such butter usually brings a very low price. The profit in dairy butter is greatest when the dairyman has a good market near at hand, and when a uniformly good product can be maintained. One of the greatest hindrances to the development of dairy butter demand is the lack of uniformity, for not only does it vary among dairymen, but the same manufacturer is often not able to make a product that has the same flavor from week to week.

In determining the best way of disposing of the milk, certain factors should be considered. The size

of the dairy and the distance from the creamery will determine whether it is profitable to go to a creamery every day, or whether it would be to the advantage of the dairyman to manufacture his milk into butter and deliver it once a week. In disposing of his product in the form of cream, fewer trips would be necessary and there would be less product to haul to the market. In the system of selling cream, the value of the skim-milk must be considered. For feeding hogs and calves, skim-milk is worth from 25 to 40 cents a hundred pounds, depending on the cost of other feeds and on the combination used.

In making butter, the increase above the pounds of butter-fat contained in the milk deserves consideration. Finished butter contains from about 82½ to 90 per cent butter-fat. The remainder of the butter consists of casein, salt, and water to the extent of about 1 per cent casein, 2 to 4 per cent salt and 10 to 15 per cent water. Some butter-fat is lost in the skimming and churning, but, in general, from one-sixth to one-fifth increase in butter over butter-fat can be obtained. As high as 50 to 75 cents a pound is paid the year round for dairy butter, and when a dairyman can secure such a price, it is perhaps more profitable to make dairy butter than to dispose of the milk in any other way. When a dairyman is able to make a good and uniform product, he can usually sell his butter to good advantage in many localities in Pennsylvania.

In the coöperative creamery where there is true coöperation and where personal differences and jeal-

ousies do not interfere, dairymen in a community can organize, build and equip a creamery and manage it to the advantage of its members.

The manufacture of ice-cream on the farms, for sale in small towns or cities, is a new industry in some sections of Pennsylvania. A number of dairymen are making ice-cream successfully and profitably. In general, however, because of its perishable character, and as it can usually be produced cheaper in larger factories, ice-cream is not destined to become a very important farm industry.

Pennsylvania farms produce a large amount of cheese. The State ranks second according to the 1920 census in the manufacture of farm cheese. The food value of cheese is almost three times that of beef of equal weight. The whole-milk cheeses, commonly known as Cheddar, or Full Cream American cheese, are made in one- to five-pound shapes and are meeting with a ready sale. The process of manufacturing the cheese is simple, and the equipment required is inexpensive. Besides the small amount of apparatus, a room for curing is necessary. About six to eight hours are needed to complete the process. The quantity is of importance, as about the same time is required to work up several hundred pounds of milk as a small amount. Whether cheese-making is profitable can easily be computed for local conditions. The whey is about one-half as valuable as skim-milk for feeding purposes. One hundred pounds of average milk will yield ten to twelve pounds of cheese. When this can be sold at 40

cents for each small cheese, weighing a pound, the returns would be from $3.50 to $4.00 a hundred pounds of milk. This, of course, would not include the labor cost of manufacture.

Brick cheese can be made in less time and with the same equipment on the farm. A great many skim-milk cheeses are manufactured in southeastern Pennsylvania. Cottage cheese or schmierkäse, requiring very little time to make, when put up in an attractive package, sells well in many towns. As much as 50 to 75 cents can be realized from one hundred pounds of skim-milk, when disposed of in this way.

Another popular farm-made cheese in some sections of the State is known as Pot or Cup cheese, also sometimes called Scalded or Briekase. This is a soft skim-milk cheese sold in cups or plates. It usually sells at about three cents a tea-cup in quantity. From about twelve to fourteen pounds can be made from one hundred pounds of skim-milk. The return from this product is from 50 cents to $1.00 a hundred pounds of skim-milk.

Still another variety, perhaps peculiar to Pennsylvania, is the Ball or Dutch cheese. This requires considerable care to make and cure, but at the same time sells at a better price. It is usually put up in packages of four balls, each weighing about two to three ounces. One hundred pounds of skim-milk will yield as much as fifty to sixty of these balls.

A number of condenseries are in operation in various parts of the State. In many cases they have

paid a sufficiently high price to make selling to them more profitable than manufacturing the milk into products on the farm, except, of course, when a producer has an unusual market and is equipped to make a good and uniform product. The effect on the community of a condensed milk plant has, in general, been good. They have improved the standards among the dairymen. They have done much to assist producers in supplying a better product, and have also educated them to produce milk more economically. Although the condenseries are, as a rule, paying a good price for milk, they are usually not located in sections where they are obliged to compete with prices for milk for direct consumption. The State already ranks third in the manufacture of condensed milk and, with the increasing demand for the various condensed and evaporated milk products, the industry is no doubt destined to grow in Pennsylvania.

The sugar grove or "bush," as it is usually called, is worth much on the farm. It not only furnishes a good income at a time of the year when there are no other special products to sell, but the work is done at a time when farm work is slack. The pleasure of the family, and often their neighbors, in getting together to gather the sap and prepare the sugar and sirup, is of no little importance. The sugar or red maples furnish the cheap source of sap in Pennsylvania. The quantity of the product is determined by the number of leaves, the amount of sunlight, and, especially, certain weather conditions. It is, there-

Plate VI. Above, a typical scene in central Pennsylvania. Below, though most of the land in Pennsylvania is rolling, tractors are being used in large numbers.

fore, necessary that the weather conditions be observed carefully. In certain sections, however, the flow is little. The equipment necessary, of course, depends on the size of the grove, but simple and inexpensive evaporators are now on the market. In general, the sap is reduced until there are eleven pounds of the sirup to the gallon measure. When put up in sealed tins, the product may be kept for months and sold as the demand arises. About forty to fifty gallons of sap are required to make one gallon of sirup weighing eleven pounds to the gallon. The sirup retails at $2 to $4 a gallon. Considerable sugar is also made in some sections.

Perishable fruits are often rushed onto the market at so low a price as to be unprofitable. This has led to the practice of drying or evaporating fruit. Inferior or damaged fruit can be evaporated and sold profitably. The old practice was to slice the fruit, put it on trays and dry it in the sun, but in recent years simple evaporators in which drying takes place by air heated from stoves or steam pipes have been put on the market. The evaporating of fruit with this new process results in a better product and at less expense. Great quantities of apples and other fruits are now being treated in this way on the farm. The evaporated fruit sells at a better price than the sun-dried. Apples and a number of the other fruits, when evaporated, furnish a cheap healthful product that will keep well.

There seems to be a decrease in the amount of preserved fruits and vegetables put up on the farm.

This is due to the greater economy of the factory methods. In some localities these large preserving plants furnish an excellent market for certain fruit and vegetable products. In the last few years factories, especially in southeastern Pennsylvania, have been buying large quantities of "wind falls" and "thinning" apples for canning purposes. These apples are preserved and sold to the hotels for pies and sauce. In some of the best apple sections in the State a price is being paid sufficient to cover the cost of thinning, besides affording a little profit. These apples heretofore have been wasted.

Vegetables and the smaller fruits are not canned on the farm to a sufficient extent to be of much economic importance except, of course, for home use.

Cider-making on the farms of Pennsylvania is only of local importance. In general, only cider for immediate use is made. A very little is bottled and sold as "Champagne cider." Some of the farm-made cider is of inferior grade because often culls and rotten apples are used instead of selected fruit. An occasional farmer, who selects his apples, using good varieties such as the Crab and Russets and mature fruit that is clean and free from rot, is making a cider which sells for a sufficient price to warrant the expense of time and product. A good clean cider made from pulp that has not be exposed to oxidation, which causes a dark appearance, and that is put up in attractive bottles or packages, is finding ready sale.

Likewise, the making of vinegar on the farm has decreased because of the cheaper manufactured prod-

uct, and the failure of many farmers to produce a uniform commodity. In general, however, those farmers who can make cider of good quality are also able to control the fermentation and produce a vinegar of good strength and uniformity. Vinegar, however, unlike cider, requires considerable time in the making. Facilities must be secured for storing the product from three to ten months, and under conditions which make it possible to control the temperature to some extent.

The woolen industry, like many others, has now been centralized and the small mills have largely been discontinued. Fifteen or twenty years ago, in central Pennsylvania and some other sections, there were woolen mills every five to eight miles. Now only an occasional mill is to be seen. The decrease in the number of sheep in these districts is also noticeable. A few mills still remain and are profitable. Their products are blankets, flannels, and yarn. These mills usually run throughout the year and employ from five to ten men. The product is commonly sold locally. Here again specialization has come. The keeping of sheep has fallen to those who make it their chief business, and large mills, with modern labor-saving machinery and with a good system of advertising, have taken the place of a large number of the small mills.

Practically all the meat sold in cities comes from the large packing centers. There are only a few packing-houses in Pennsylvania. The small cities and towns secure part of their supplies of ham,

bacon, and sausage from the local farms. A large amount of meat is handled on the farms in Pennsylvania. According to the last census, its value was almost $16,000,000. The slaughtering and preparing of a considerable number of meat products can be done during the winter. Salted pork, dry cured pork, head cheese, scrapple, souse, lard, sausage, smoked meats, bologna, soap, and candles are a few of the products made from meat on Pennsylvania farms. Of this list, scrapple, which is largely demanded in sections of Pennsylvania, may be unknown in some other states. It is a mixture of ground meats and cornmeal. During the winter especially there is great demand for sausage properly seasoned and prepared. Country smoked meats are saleable to good advantage, and the cost of preparation is not great. In many localities there is an opportunity to market them to advantage. Many farmers can profitably dispose of their meat in some of the various forms, providing they make an extra good article, using scrupulously clean methods and sell directly to the consumer who knows the conditions under which it has been cured. The large packing-houses are equipped to manufacture various by-products and use all of the animal for one purpose or another. It is not, therefore, profitable for the farmer to manufacture meat products except for his own special trade.

Practically no more virgin timber exists in Pennsylvania. The large mills in the past have cut out almost all the forests. There are, however, excellent

woodlots and small tracts of timber on the farms. There could be more trees planted to advantage, especially on the mountain-sides, which are worth but little for other purposes. Farm woodlots are being started in many localities. The large mills have gone and are being replaced by what is known as the "portable mill," which can be moved at a comparatively low cost. The chief manufactured products on Pennsylvania farms from timber are ties, poles, firewood, charcoal, and axe-handles. The first four are rather extensive in some parts. Farmers who own small tracts of timber can produce these finished articles to advantage.

Posts, in general, are not milled, although occasionally large trees are used. Chestnut, oak, and cedar are the most common post woods, although since the introduction of creosote, some of the softer woods have been employed to advantage. By the use of creosote the life may be increased from one to two times. Poles of various kinds are largely of chestnut. For railroad ties of different sizes, for both the wide and narrow gage, chestnut, oak, and cedar are used, and in some sections are made in large quantities. On account of the location of the coal mines, there is not as great demand for cord, or firewood, as in some other states. However, there is a small demand, and cordwood can be secured advantageously out of the short pieces in the making of poles and ties.

Although Pennsylvania has only a few mills that manufacture flour and other products for the large

markets, nevertheless the number of mills in the State is second only to that of New York. A large number of mills that make flour and grind feed for local use are scattered throughout the farming districts only a comparatively few miles apart. Flour is manufactured from the wheat brought in by the farmers, and in recent years western spring wheat has been blended with the local winter wheat, making a satisfactory flour.

Occasionally farmers are provided with steam or gasoline and often electrical power to such an extent as to be able to grind their feed as required. Small and inexpensive disk mills are used, but, on account of the large number of streams that furnish water power, the local mills can usually grind feed as cheaply, if not cheaper than the farmer. In some sections, of course, the distance of hauling will be an item to consider, but in the agricultural districts, the mills are located conveniently.

In general, these mills are not very profitable, making perhaps a good living for the miller, but in some cases he is obliged to develop side lines, such as selling coal and by-product feeds, and even furnishing electric lights for the small towns in order to make his venture profitable. From the standpoint of the farmer, however, these mills are a great advantage.

CHAPTER X

GOVERNMENTAL WORK FOR COUNTRY LIFE

Pennsylvania has taken many measures to promote agriculture and the betterment of rural conditions. Some of these are regulatory and protective in nature and others are of a constructive character.

Owing to the frequent references necessary in stating the agencies employed in the enforcement of the State laws here discussed, it is needful to describe very briefly the several classes of municipalities into which the Commonwealth is subdivided. The prime subdivisions are called counties, the first three of which were established by William Penn in 1682 in the Charter of Liberties of the province. At present there are sixty-seven counties in the State, each with its governing business board of three county commissioners and with a sheriff as the principal officer of the peace.

The counties in turn are subdivided into townships, of which there are two classes: Townships of the first class, of comparatively dense population; townships of the second class, which include the rural districts. The principal business officers of the township are the supervisors, although in many

counties there are overseers of the poor, who care for the township as a poor district; there are also school directors, who look after the business of the usually coterminous school districts. The principal officer of the peace of the township is the constable. As this chapter deals exclusively with rural affairs, the more populous municipalities, cities, boroughs, and towns are not here classified and discussed. The powers of the governing boards of the counties and townships respectively are specifically set forth and limited in the laws of the Commonwealth, which describe not only what these local bodies may do, but precisely what procedures they must follow.

The township constable is an elective officer charged not only with certain duties in the conduct of elections and with the executive duties pertaining to the township court or office of the justice of the peace, but also with the preservation of the public peace. He is empowered to arrest without warrant those whom he sees engaged in or threatening to become engaged in an affray; also those charged with felony or, on probable grounds, suspected thereof; and finally, to enter a dwelling forcibly to suppress criminal disorder therein and, in making arrests, to demand the assistance of others. The sheriff of the county likewise has responsibilities for the keeping of the public peace and has very large powers to swear in deputies and to demand the assistance of citizens when extensive disorder makes such aid necessary. These local officers are, however, not required to maintain any continu-

ous or systematic patrol, such as is supported by the police of the larger cities. The country householder and the traveler upon the rural highway are often endangered because of the lack of such police patrol. The constable is paid by fees and these often depend on his success in making an arrest and have no relation to the time required by such service. This discourages persistence. The system described worked fairly well while rural districts were thinly populated and the urban population also was small. However, on the rise of great cities and the increase in rural population, it became evident that the agencies just described must be supplemented by some agency continuously operating, thus providing more adequate protection to the entire rural population.

In 1905 the Legislature (P. L. 1905, page 361) created the Department of State Police, with the intent that the members of the State Police organized under this act should, as far as possible, take the place of the police appointed from time to time at the request of various corporations; also that they should serve the better to protect the peace of rural communities. The State Police consists (P. L. 1919, page 336), of five troops, each of eighty-three officers and privates. The members of the force are selected by a strict examination as to physical qualification and character, and are, for the most part, men who have had previous military training. The force is distributed in small groups among barracks located in various parts of the State and, in still smaller units, in outlying stations, so that they may

act most promptly and efficiently in the preservation of order and the prevention of crime; but these groups are quickly merged when extensive disorder in any locality requires their services, as has been demonstrated in several instances.

Members of the State Police are clothed with the powers and prerogatives conferred by law on members of the police force of cities of the first class or on constables of the Commonwealth, and are required, wherever possible, to coöperate with the local authorities in detecting crime, apprehending criminals, and preserving law and order throughout the State. They are ex-officio game protectors, forest-, fish- and fire-wardens. This body of finely selected and disciplined men, serviceably uniformed, mounted and equipped, has proved remarkably efficient, and has won high repute for cool-headed judgment and relentless determination. The recent organization of part of the force as motorcycle men has greatly increased its efficiency. While their riot service in industrial centers has attracted most attention, they have contributed much to the safety and order of the rural communities by a system of highway patrol, not continuous in any locality, but appearing, now here, now there, without warning, and by the prompt and resolute aid they have given to the local officers of the peace in dealing with the hardier elements of disorder. A recent report of the Superintendent of Pennsylvania State Police declares that 85 per cent of the service performed is rendered to the rural communities.

STATE DEPARTMENT OF AGRICULTURE

This branch of the State government is the executive agency through which are enforced those laws of the Commonwealth that deal most specifically with the inspection of agricultural supplies and products and with the suppression and quarantine of diseases of domestic animals and of cultivated plants. It has also other functions for the promotion of the economic development and maintenance of agriculture, to some of which allusion will be made later.

The Department of Agriculture is the offspring of the State Board of Agriculture, which was organized in 1877 under a legislative act of 1876, introduced by John P. Edge. The Board was composed chiefly of delegates elected by those county agricultural societies which, under the act of 1851, received financial aid from their respective counties. Other members were appointed by the Governor and still others held their membership by virtue of their holding certain offices in the State.

The Board thus constituted performed a very large volume of various services to the agriculture of the State, but with the growth of the duties assigned to it by the Legislature, it came to be judged that an executive department would function more efficiently. Accordingly, by the act of 1895 (P. L. 1895, page 17), the State Department of Agriculture was created, whose head was appointed by the

Governor of the Commonwealth and was ex officio Secretary of the State Board of Agriculture. The responsibility for the administration of laws relating to agriculture and also for the conduct of the farmers' institute system in Pennsylvania was placed on the head of the Department. By appointment of the Governor, Thomas J. Edge, who had served as secretary of the Board from its organization until the creation of the State Department of Agriculture, was made the first Secretary of Agriculture.

The State Board of Agriculture continued to function in an advisory way on legislative proposals related to agriculture and its members usually acted as the local organizers in the system of farmers' institutes. In 1919, however, in connection with the reorganization of the Department of Agriculture and the re-definition of its duties, the act under which the Board was organized was repealed.

The State Department of Agriculture has six main administrative subdivisions designated as bureaus, each with its executive head who is known as the director. The bureaus are those of animal industry, plant industry, markets, foods, chemistry, statistics. This arrangement was provided by the Act of May 8, 1919. The Act of June 7, 1923, known as the Administrative Code, abolished all administrative departments and subdivisions of the State government, at the same time it recreated a Department of Agriculture. Following the passage of this Act this Department was reorganized, by the Secretary of Agriculture and the Executive Board,

substantially as it previously existed. Each of these subdivisions, with the exception of the Bureau of Statistics, is charged by legislative enactment with the duties of administering certain laws which affect agriculture.

Bureau of Animal Industry

This Bureau is a continuation of a previously existing subdivision of the Department of Agriculture which was known as the State Livestock Sanitary Board. The Board was created by the Act of May 21, 1895, and was composed of the Governor, Secretary of Agriculture, Dairy and Food Commissioner, and State Veterinarian. The Governor was president of the Board, and the State Veterinarian ex officio secretary. Prior to 1895, matters pertaining to live-stock were administered by the then existing State Board of Agriculture but there was no steadily employed official veterinarian. The Act of March 31, 1895, which created the Department of Agriculture, provided for an official State Veterinarian.

The reorganizing Act of 1919 changed the name of the State Livestock Sanitary Board to that of Animal Industry, with the State Veterinarian as Director of the Bureau. All powers and duties of the Board were transferred to the Bureau and its executive officer.

The chief functions of this Bureau are those of conserving and improving domestic animals by administering certain laws pertaining to the control and suppression of communicable diseases, and se-

lection of the better and healthier types for breeding. This naturally leads into the field of research and investigational work, which is met by the pathological and biological laboratories maintained in connection with the Bureau. These activities indirectly merge into the function of protecting public health by the control of animal diseases communicable to man and by efforts to prevent the consumption of unhealthful food products of animal origin.

The several laws which are specifically charged to the Bureau are the Acts of July 22, 1913, page 928; May 28, 1915, page 587; May 21, 1895, page 91; April 27, 1909, Sec. 2, page 189; March 30, 1905, Sec. 6-7, page 78; May 11, 1921, page 522; April 21, 1921, page 200; and the amendments to the foregoing.

Bureau of Plant Industry

Section 4 of the Act of March 13, 1895 (an Act to establish the Department of Agriculture, and define its duties, and provide for its proper administration), provided for the appointment by the Governor of an Economic Zoologist. The Nursery Inspection Law of March 31, 1905 (an Act to provide for the protection of trees, shrubs, vines, and plants against destructive insects and diseases), provided for the official examination of nurseries by the Secretary of Agriculture through the Economic Zoologist, and also for the inspection of any orchard, or public or private grounds for San José scale, or other insect pests or diseases. This was amended by the Act

of April 15, 1907, which authorized the Economic Zoologist to acquire and disseminate knowledge of all kinds of insects and their enemies, and the means of suppressing injurious species, and maintaining beneficial kinds. The Nursery Inspection Act of 1905 was supplemented by one approved on May 5, 1911, which provided for the inspection of apiaries, and for the suppression of contagious and infectious diseases among bees. The Nursery Inspection Act of 1905 and the amendment to this of 1907 were repealed by the Act of June 29, 1917, providing for the protection of agriculture and horticulture. The Act of 1917 was amended "to prevent the introduction into and the dissemination within the Commonwealth of insect and disease pests injurious and harmful to plants or plant products; providing for the inspection of nurseries; providing for quarantines necessary to the enforcement of this Act; and imposing penalties."

All of these laws were again repealed and replaced by the broader and more specific Act of June 29, 1917 (an Act to provide for the protection of agriculture and horticulture, and to prevent the introduction into and the dissemination within the Commonwealth of insect and disease pests injurious or harmful to plants or plant products; providing for the inspection of nurseries; providing for quarantines necessary for the enforcement of this Act; and imposing penalties). The Act of May 8, 1919, reorganizing the Department of Agriculture again repealed the previous laws relating to the Economic

Zoologist. This law provides for the organization in the Department of Agriculture of a Bureau of Plant Industry, and assigned to the Bureau of Plant Industry all the powers previously conferred by law on the Secretary of Agriculture (relating to the work of the Economic Zoologist) and the Economic Zoologist.

The Act of 1919 also provided for the inspection of apiaries for diseases inimical to bees and bee-keeping, and for the enforcement of the laws relating thereto. The original Apiary Inspection Act supplemented the Nursery Inspection Act, and provided for the inspection of apiaries, and for the suppression of contagious or infectious diseases among bees. The apiary inspection laws were later repealed by the Act of April 6, 1921, "relating to agriculture, and the sale, giving, and transportation of bees, honey, hives, and appliances; providing for the inspection of apiaries, and for the prevention, control, and eradication of contagious and infectious diseases among bees, and the establishment of quarantines; prescribing the style of hive to be used after July 1, 1923; imposing certain duties on certain persons engaged in transportation, and providing penalties and appropriations therefor."

By the Act of April 29, 1913 (an Act to regulate the sale of certain seeds; providing for the selection of samples thereof, and their examination by the Department of Agriculture, and the preparation of information concerning the same; providing also for the enforcement of the act; and fixing penalties

for its violation), the Secretary of Agriculture is required to examine commercial stocks of cereals, buckwheat, grass and other leguminous seeds as to their purity and freedom from weeds. This was repealed and its place taken by the Act of April 26, 1921, "regulating the selling, offering, or exposing for sale of agricultural seeds and mixtures of the same for seeding purposes; forbidding the sale of seeds unfit for seeding purposes; and providing for the prohibition of such sales by injunction; providing for the taking and examination of samples of agricultural seeds by the Secretary of Agriculture and his agents, and the publication of information gained from such examinations; providing for the enforcement of the Act; and providing penalties for its violation."

From time to time laws have been enacted relating to specific insects or diseases, imposing on the Secretary of Agriculture the duty of undertaking the control or eradication of such diseases or insect pests. The Act of April 18, 1919, for example, provided for the control and eradication of the European wart disease of potatoes; provided for the investigation of the disease, and determination of methods for controlling or eradicating it, and authorized the Secretary of Agriculture to control, supervise, and regulate the planting, growing, digging, storage, and marketing of potatoes in any area affected by the disease, or in any area adjacent thereto. The Act of July 2, 1923, provided for the quarantine and control of the Japanese beetle. This

law authorizes the Secretary of Agriculture to make investigations of the prevalence of the beetle, and the means whereby it may be controlled, and its dissemination limited, and it gave to the Secretary of Agriculture the right to establish quarantines and quarantine regulations, and to enforce such rules and regulations as were necessary. The seriousness of the pest makes rigid regulations imperative.

The Act of June 7, 1923, known as "The Administrative Code," abolished the Bureau of Plant Industry as such. This legislation, however, provided that the Department of Agriculture should continue to exercise all the powers, and perform all the duties by law vested in, or imposed on the Secretary of Agriculture, or the Bureau of Plant Industry. The Secretary of Agriculture has established the Bureau of Plant Industry, and has assigned to this Bureau various powers and duties hitherto performed by the Economic Zoologist, or the Bureau of Plant Industry.

The Bureau of Plant Industry, as it is now constituted, is divided into certain main divisions, for the better and more economical and efficient conduct of its work. These divisions are as follows: Administration; apiary inspection; botany; entomology; nursery inspection; plant pathology. To each is assigned that part of the work of the Bureau which the name of the division would indicate. The various lines of work undertaken by the several divisions go back to the earlier general laws for their legal authority, particularly to the Nursery Inspection

Law, the Seed Law, and the Apiary Inspection Law.

Bureau of Foods

The Bureau of Foods of the Pennsylvania Department of Agriculture is charged with the enforcement of all laws placed under its supervision, relating to foods and non-alcoholic drinks, as well as with supervision over the sanitary condition of cold storage plants as to the wholesomeness of products offered for storage. The Pennsylvania cold storage industry approximates an investment of $75,000,000. The Bureau also has supervision over the egg-opening establishments where eggs are opened and removed from the shell and sold in liquid form.

The several laws committed to the Bureau of Foods are enforced through special agents, each in charge of a determined district. The Director of the Bureau of Foods is the executive officer, who frequently meets the agents for conference so as to secure uniformity and coöperation in directing the work.

The analytical work is performed by six different chemists. One is located at the Experiment Station Laboratory, State College; one at Scranton; one at Philadelphia; one at Erie; one at Pittsburgh; and one at Harrisburg. The analytical work is being paid for at so much a sample analyzed, except at Harrisburg where the chemist works on salary. This system is regarded as having several advan-

tages, when the examination of perishable foods is involved. It also results in economy in traveling costs. Uniformity of procedure by chemists is obtained through their organization as a Board, which meets on the call of the Director to consider questions relating to their work.

The laws enforced by the Bureau of Foods include the following: the General Food Act, laws prohibiting imitation dairy products, adulteration or coloring of milk and cream, sale of adulterated vinegar, acts in regard to cheese, oleomargarine, renovated or process butter, fresh meat, poultry, game and fish, fruit sirup, non-alcoholic drinks, rotten eggs, lard, sausage, milk and cream, coffee and chicory, egg opening, cold storage, fresh eggs, ice-cream, filled milk, milk testing.

Bureau of Chemistry

This Bureau was organized in the Department in 1905 to care for the enforcement of the concentrated feeding stuffs law. All chemical work for the Department, except that belonging to the Bureau of Foods, has now been assigned to the Bureau of Chemistry. It is now charged with the enforcement of the several laws regulating the sale in Pennsylvania of fertilizers, agricultural liming materials, concentrated feeding-stuffs, insecticides and fungicides, linseed oil, paints, putty and turpentine, and with the required chemical work under these acts.

The first regulatory legislation committed to the

State Board of Agriculture for enforcement was the fertilizer law of 1879, which resulted from an investigation made in 1876 by F. A. Genth, of the University of Pennsylvania, then consulting chemist of the Board. The latest amendment to this law is that of May 29, 1917. The act defines commercial fertilizers to include every substance sold for fertilizing or manuring purposes except the dung of domestic animals, lime, marl, and wood-ashes. Each brand of fertilizer must be licensed annually before sold in the State, the manufacturer or dealer therein being required to file with the Secretary of Agriculture before the first of January of each year a statement of the name and address of the manufacturer, the brands and analyses of commercial fertilizers to be sold during that year; also a statement of the minimum guaranteed composition of each brand in terms of the minimum percentages of nitrogen, ammonia, total phosphoric acid, available phosphoric acid, and potash soluble in water. The cost of license varies with the tonnage of the brand sold in the State the preceding year, concerning which the applicant must make affidavit to be filed with his application. The fee varies from $15 for new brands and for sales of 150 tons or less up to $50 for amounts exceeding 500 tons for old brands re-registered. Each package of the goods must bear a statement of the net weight of the contents, the brand name, the name and address of the manufacturer or importer or other dealer selling in the State; also the minimum guaranty in the terms

above mentioned. The sale of "pulverized leather, hair, ground hoof, horns, or wool waste, raw, steamed, roasted or in any form" as a fertilizer or as an ingredient thereof is prohibited unless a statement of the fact is conspicuously affixed on every package. The potash may be claimed to be "derived from" or "equivalent to" sulfate of potash if there is no more chlorine present than would unite with ½ per cent of potassium oxide. Certain variations in the form of the guaranty are permitted in the case of non-acidulated goods and raw materials, but, with basic phosphate slags, the available phosphoric acid must, for the present, be expressed in terms corresponding to the results of analysis by the Wagner method. A separate law approved April 23, 1909, prohibits the use of the word "bone" as part of the name of any brand, unless the phosphoric acid contained in the fertilizer shall be the product of pure animal bone.

Prior to the summer of 1916 the chemical work of fertilizer control was performed by contract, by F. A. Genth from 1879 to 1881 and from the fall of 1885 to 1889; and in the laboratories of The Pennsylvania State College under the direction of W. H. Jordan from 1881 to 1885 and under that of William Frear from 1889 to 1916. The Secretary of the Board and later of the Department, however, has always retained direct responsibility for the fixing of policies, for final executive decisions on legal questions, for the direction and supervision of the sampling and of all matters pertaining to

licensure. Owing to the brief periods at which the fertilizers are in transit from the manufacturer to the farmer and to the large area and diversified topography of the State, the actual sampling has been performed by local agents of the Department [but much care has been used in working out the regulations for the sampling procedure and in instructing the agents therein. Most of the local agents have served for years in that capacity.]

For more than a quarter of a century after the enactment of the fertilizer law, the widespread publication of analytical results through Department bulletins was relied on to prevent large departures from manufacturers' guaranties. The experience through that period has amply shown that, for the most part, this method, supplemented by the work of competitive fertilizer sales agents, served to prevent serious abuses on the part of most manufacturers. However, there were a few who, despite the wide publicity thus secured, succeeded in doing a large volume of business fraudulently. During the latter years of fertilizer control, therefore, prosecutions before the courts have been employed to bring the recalcitrant manufacturers to the mark. Manufacturers' reports to the Department show that the volume of fertilizer sales in Pennsylvania during recent years has averaged approximately eight million dollars annually.

Investigations in the Experiment Station laboratory having shown serious abuses and confusions in the sale of agricultural liming materials in Penn-

sylvania, on request of the State Board of Agriculture the Legislature in 1915 enacted a law, approved June 1 of that year to regulate trade within the State in such materials. This differs quite distinctly from the lime laws previously enacted in other states in that it defines the several kinds of such products and covers land-plaster as well as lime in the various oxide, hydrate, and carbonate forms. Air-slaked limes, kiln slakes, gas-house lime or tanners' lime, when sold as such, are, however, exempted from the provisions of the act. Furthermore, the products of any kiln or quarry, when delivered directly therefrom to the wagon of the consumer, are exempted from the legal regulation. As with the fertilizer law, an annual license is required for the manufacture and sale of such commodities in the State, the licensure being in the hands of the Secretary of Agriculture. The license fees are graded according to volume of sales of each brand in the preceding year, being from $5 for less than 1,000 tons up to $10 for sales in excess of 5,000 tons. An affidavit of minimum composition for each brand must be filed with the application and all packages correspondingly tagged or, if sold in bulk, the product must be accompanied by a tag giving the name of the manufacturer or importer, the name of the brand, net weight of package contents, and certain declarations of composition and condition as follows: In the case of carbonates, other than marl, the maximum coarseness of particle and the minimum percentages of calcium oxide and magnesium oxide and

their carbonate equivalents; with oxides, hydrates and marl, the minimum percentages of available oxides of calcium and magnesium; and in the case of gypsum or land-plaster, the minimum percentages of available calcium oxide and sulfur trioxide.

Despite the fact that Pennsylvania has a developed business in the manufacture of lime products exceeding that of any other state, certain parts remote from the better limestone beds are supplied from Maryland, New Jersey, New York, Ohio, and even from Michigan. The annual turn-over of agricultural liming materials used in the Commonwealth is estimated to approximate three millions of dollars in value.

Following a coöperative investigation between the Experiment Station and the State Department of Agriculture in 1899-1900, the Legislature in 1901 enacted a commercial feeding-stuffs law similar to those previously passed in several of the New England states and in New York. This was approved April 25, 1901. The original law has been superseded by the Act of May 3, 1909, and amended May 11, 1921, and March 19, 1923. The law in its present form is a licensing and a labeling act. Its provisions cover all concentrated commercial feeding-stuffs, but specifically exempt hays, straws, corn stover, unmixed whole grains, the unbolted or unsifted meals from single cereal grains, and mixtures of the pure unground grains not having trade names. The concentrated feeding-stuffs regulated by the law include not only vegetable, but also animal

materials and by-products, and each is defined according to the recommendations of the National Association of Feed Control Executives. A long list of vegetable materials of very little feeding value, weed seeds and materials deleterious to health of domestic animals are excluded from admixture with commercial feeding-stuffs. It is provided that the presence of certain low-grade materials in feeding-stuffs, such as oat hulls, cottonseed hulls, flax plant refuse and elevator chaff, that do not contain more than 11 per cent of crude fiber, shall not be deemed an adulteration and also that the grinding of corn on the cob, alone or with other grains, or the admixture of corn-cobs with exclusively grain feeds, in proportion not to increase the crude fiber above the percentage just stated, are allowed. Pennsylvania has a large industry in milk and pork production, fattening of beef and in poultry husbandry. The annual turn-over of such commercial feeds sold in the State represents values of many millions of dollars. For three years after the enactment of the law, the chemical work relating thereto was performed under contract in the Experiment Station laboratory, but since then has been conducted in the laboratory of the Bureau of Chemistry of the Department at Harrisburg.

The Bureau of Chemistry also has the enforcing of the paint, putty and turpentine Act of June 1, 1915, and previous acts.

The Bureau of Chemistry also coöperates with other bureaus and departments of the State govern-

ment, as directed by the Secretary of Agriculture, in the examination of certain materials, especially that of the Bureau of Animal Industry, in connection with suspected cases of animal poisoning and other live-stock difficulties.

For the past several years the Bureau has practically been self-sustaining because of the revenue received in registration fees for fertilizers. This has especially been the case since 1921 when the feeding-stuffs registration fee requirement became effective, so that during 1922 and 1923 the total revenue received from all sources has doubled the appropriation allotted to the Bureau for its work. The activities now show that approximately 5,000 samples of materials are analyzed annually and that over 5,000 brands of fertilizers, feeding stuffs, and lime products are registered.

Bureau of Markets

The establishment of the Bureau of Markets was authorized by an act of July 17, 1917, and authority enlarged and defined by an act of July 9, 1919, repeating the earlier law. Under these acts, the Bureau has power to investigate the marketing of farm products, to gather and diffuse information regarding the supply, demand, prevailing prices, and movement of farm products; to assist and devise in the organization and conduct of public markets, cooperative, and other associations for improving marketing conditions; to investigate delays, embargoes, conditions, practices, charges, and rates in the

transportation and storage of farm products; to take lawful steps to prevent waste of perishable goods; to establish standard grades for farm produce and provide inspection service; to establish standard containers for farm products with the Bureau of Standards of the Department of Internal Affairs; to secure the coöperation of other agencies.

The work of the Bureau is prosecuted under five major projects, chiefly developed along commodity lines. In addition, tobacco standardization work is being carried on with the United States Department of Agriculture and tentative tobacco grades have been worked out and are being tested prior to final adoption.

Market information of various kinds is distributed from Harrisburg and three local offices at Lancaster, Wilkes-Barre, and Scranton, with joint employees of the Federal Department at Philadelphia and Pittsburgh. Reports are distributed through the press and, in addition by radio at Philadelphia, Lancaster, Harrisburg, and Pittsburgh. Special services are rendered during the marketing season to grape, apple, and potato-producing areas.

A thorough study of the marketing of wheat has been the chief work in grain and hay marketing. A study of receipts and grades of all wheat received at Philadelphia and Baltimore from Pennsylvania shipping points since 1920 has been made and kept up to date. The chief causes of trouble in wheat marketing are too many varieties, failure to purchase by grade, milling of flour which is not uniform,

selling flour on export markets rather than development of home consumption, and failure to reduce losses through presence of garlic, cockle, and Angoumois grain moth. A system of licensing graders will be put into effect in some sections of the State in 1924, in order to provide for purchase of wheat by grade from the farmers. The Federal standards for wheat have been adopted. Through the cooperation of interested millers a blend of spring wheat with the better grades of soft red winter wheat as produced in Pennsylvania has resulted in a very satisfactory flour for bread purposes. The use of the flour by bakers has been so satisfactory that the demand exceeds the supply available at the present time. The State uses about double the flour that it produces, so that home markets can be substituted readily for the export trade when the quality of flour is reliable enough to justify such action. Through better fumigation of wheat on the farms and the installation of grain driers at mills and elevators, losses from moth and garlic can be reduced greatly.

Except in the case of apples, potatoes, and grapes, Pennsylvania is not a shipping state for fruits and vegetables. Even in the case of these commodities, receipts at the numerous markets greatly exceed the shipments. Work in this field must, therefore, largely tend toward the use of local markets. Railroad records for fifteen cities have been studied and the origin and time of arrival of all carlot receipts of fruits and vegetables secured for 1921, 1922 and

1923. Statistics of this character are very valuable to stimulate interest in local production. Carlot shipments by stations have been secured from the Federal Department covering the years beginning with 1920 and have been analyzed by station and commodity. The recommended United States grades have been adopted for apples and potatoes. Shipping point inspection on apples and peaches has been carried on in Adams, Cumberland, and Franklin counties, and on potatoes in Potter County, covering about 275 cars in all in 1923. Grading demonstrations are given wherever there is interest locally and considerable work has been done in planning packing-houses and storages.

A recent addition is the poultry marketing work. Studies are being made of marketing conditions and grades at shipping points and markets with a view to the improvement of any parts that are not efficient or economical. Information regarding volume and sources of supply of poultry and eggs are being secured from the various important cities over the State. It is evident that some protection should be afforded the purchasers and reliable producers of baby chicks against the inferior grade of chick that is being produced in many hatcheries. Several states have already undertaken work along the line of the accredited hatchery plan. The development of a system in Pennsylvania based along similar lines is under consideration at the present time.

There are practically 100 coöperative organiza-

tions in Pennsylvania chartered under the 1919 law in addition to 172 locals of the Dairymen's League Coöperative Association. These associations handled a variety of products including milk and dairy products, fruit, vegetables, potatoes, tobacco, seed corn, live-stock, and farm supplies. The work of the Bureau with these societies has been chiefly during the organization and earlier stages of development. It has become increasingly evident that a thorough study of the field should be made before a new organization is actively evolved. In this way many mistakes can be avoided, including those associations which will not have sufficient business or for which there is not a real need in the community.

COUNTY FAIRS

For many years the Legislature has appropriated funds for the support of county agricultural fairs under a succession of acts varying considerably in their provisions. These grants in general equal the amounts paid by the fair association as premiums on exhibits, up to $1,000 a fair with a maximum of $2,000 a county, exclusive of those for trials of speed. The association must be incorporated and must annually hold exhibitions of not less than three days' duration in the interest of stock-raising, grain, poultry, handiwork, dairy products, and the like. The act is administered through the Pennsylvania Department of Agriculture.

BUREAU OF STANDARDS

The Pennsylvania Bureau of Standards of the Department of Internal Affairs was created by Act 842, amended by Acts 176 and 414, for the purpose of regulating and maintaining a uniform standard of legal weights and measures to conform with the original standards as adopted by Congress and verified by the National Bureau of Standards; also to assist in securing the enforcement of laws relating to city and county sealers of weights and measures. The Secretary of Internal Affairs appoints a competent person to serve as Chief of the Bureau whose duty it is to have custody of the State standards. The city and county sealers submit their measures of weight, length, and capacity to the Bureau to compare with, correct and certify to the standards in the custody of the Chief.

The Bureau of Standards is authorized under Act 187 to pass on each type of weight and measure and weighing and measuring device manufactured, offered or exposed for sale or sold or given away, for the use in trade or commerce, in the Commonwealth of Pennsylvania, and to approve or disapprove of said type. The Bureau shall approve each type of weight and measure and weighing and measuring device submitted to it for approval by any person if such type is so designed and constructed that it conforms to, or gives correct results in terms of standard weights or measures or in terms of

values derived therefrom, and is reasonably permanent in its indication and adjustment, and does not facilitate the perpetration of fraud; otherwise the Bureau shall disapprove the same for the protection of the public.

Rules and regulations for the carrying out and enforcement of this act, not inconsistent with the provisions thereof, shall be adopted by the Bureau of Standards, with the approval of the Secretary of Internal Affairs. These shall include reasonable variations or tolerances which may be allowed on weights and measures and weighing and measuring devices included within the provisions of the law, and also specification for such weights and measures and weighing and measuring devices for the guidance of manufacturers in their design and construction.

Act 177, 1911, as amended by acts 303, 368, 1917, and Act 131, 1921, provides for the appointment of county and city inspectors of weights and measures, for their compensation, expenses and duties. Each inspector shall report in writing, at least once every month, to the Chief of the State Bureau of Standards, upon blanks furnished. Such reports shall contain: The number of tests made since the preceding report; the number of weights, measures, and balances found by such tests to be correct; the number discovered to be false; the prosecutions instituted by such inspector since the last report, together with the name of the accused, the title of the court where the prosecution was instituted, and the

result; such other matters as the Chief may, from time to time, prescribe.

Another act defines and regulates the sales of commodities, making it mandatory that goods put up in package form shall be marked plainly and conspicuously with the quantity of the contents in terms of weight, measure or numerical count, provided that the Chief of the Bureau of Standards shall establish tolerances and exemptions on small packages.

This act also lists eighty-one commodities; when sold by the bushel, the latter shall contain the number of pounds herein stated, and if sold in the subdivision of the bushel, the number of pounds shall consist of the fractional part of the bushel. This act also pertains to bottles or jars used for the sale of milk or cream, which shall be considered as measures within the meaning of this act, subject to rules and regulations covering tolerances.

Act 147, 1919, as amended by Act 152, 1921, provides for the examination of the glassware used for testing milk and cream for butter-fat with the "Babcock" test, prohibiting the use of inaccurate testing glassware and defining the Standard Babcock glassware.

The Bureau of Standards also acts in conjunction with the Bureau of Markets of the Department of Agriculture in enforcing Act 337, 1919, in establishing and promulgating standards for receptacles for farm products; also to make such rules and regulations under this act as may be deemed necessary

to enforce the section relating to standard receptacles.

STATE HIGHWAY DEPARTMENT

Only in very recent years has the State contributed to the cost of making and keeping up the rural roads. It is true that, a century ago, the Legislature directed the opening of certain highways between important centers, and designated commissions to survey the routes, but the cost of construction and maintenance fell, and often very unequally, on the political districts traversed. The single exception is the old Cumberland road, built as a national highway, but later taken over by the State. This was maintained under the supervision of State-appointed superintendents, but as a toll-road.

The burden of opening, constructing, and keeping up the thousands of miles of rural highways which thread the numerous valleys and cross the ever-visible streams, hills, and mountain tops of Pennsylvania's varied surface, was borne, for more than a century after the province assumed the constitution of a state, by the rural population, except as turnpike roads supplemented the public highways; and the revenues of these were very largely derived from the countrymen.

The procedure for opening roads and for their construction and maintenance was laid down in the law of June 13, 1836, and its supplements, which have ever since governed this phase of rural affairs.

Public highways were determined on and located by boards of view appointed by district courts at the petition of interested citizens, subject to the Court's approval of the report of the viewers. Claims for property damage resulting were presentable to the Court and the damages assessed, if any, by a separate board of view, subject to the Court's approval.

The sole legal requirements concerning the character of the public road was that, whenever practicable, it should be laid out "at an elevation not exceeding five degrees, except at the crossing of ravines and streams, where by moderate filling and bridging, the declination of the road may be preserved, within that limit"; also, that the breadth of public road shall not exceed fifty feet; and finally, that when approved as aforesaid, the road shall, as soon as practicable, be opened effectually and constantly maintained in repair, and at all seasons kept clear of all impediments to easy and convenient passing and traveling.

The actual construction and maintenance of a public road so authorized devolved on the township supervisors. These officers were given extensive powers to take materials needed for road surfaces and for bridges, and to levy taxes and contract debts, within the limit of two mills on the assessed valuation of the township, to defray the costs. Since, however, it was optional to the person taxed whether to pay in cash or in labor, most of the road work of the nineteenth century was paid by the labor tax. The work was done when convenient to spare the

Plate VII. Modern commercial apple orchard, Chester County.

labor from the farm, not when the road most needed it. That supervisor who was least exacting of his fellow tax-payers was usually the most popular. His road-making skill was not the chief ground of his election. Rotation in office rather than continuity of service and policy was the prevailing practice. Supervisors, unless compelled by direction of the court or by threat of petition to that authority, commonly favored the roads near their own properties. This, of course, tended to confirm the rotation in office, to the end that other parts of the township might in turn receive attention. Engineering principles had little influence on road location and almost none on construction and maintenance. The abundance of material near-at-hand for the proper repairing of roads was far too little used, in order that the temporary costs might be kept down. Continuity of road policy was impossible. Little road-making machinery was used. The trench-plow, stone-boat, farm wagon, pick and shovel, with an occasional napping-hammer, were the implements employed in construction and repair, and these were supplied by the working tax-payer, not by the road officials. The result need not be described. The fault was not in the laxity or dishonesty of the road officials, for they were usually very worthy citizens. The root of the difficulty lay in part in the lack of appreciation of the farming public of the economic and social values of good roads, in part in the absence of public enterprise. For, under these conditions, private enterprise built and maintained

turnpikes or toll roads between main points of travel, and often paid excellent dividends; but the paying public was generally dissatisfied with the quality of the service rendered by the private companies and began to urge state management.

In the decades, late in the past century, when the bicycle reached its maximum use, the city dweller wheeled, far from his customary limits, upon the country highways. He was commonly regarded as a strange trespasser, and such was the degree of hostility he encountered, that a special law (Act of July 20, 1889) was deemed needful to define his highway rights. Collectively, the bicyclists demanded better roads. Few of the countrymen who had to pay for road improvements rode bicycles. It is not strange that their ears were dull to the demand.

In the late nineties, however, when John Hamilton became Director of Farmers' Institutes, he made the discussion of good roads as an economic need of agriculture and an advantage to rural society a required part of every institute program. For a number of years, the pros and cons of the subject were argued in every farm community in the State. A more intelligent judgment on road questions and a warmer interest in better conditions developed. Undoubtedly, the invention of Henry Ford, sold in every hamlet to a large proportion of the near-by farmers, has since quickened the interest in this betterment.

As the result of these influences, new laws were

passed affecting township roads. The "Hamilton road law" (June 23, 1897) provided for a board of three supervisors with overlapping terms, to make possible a continuous policy. They were required to divide the townships into districts with not more than five miles of road in each, and to appoint to each a road-master who was to work upon the road himself, to direct the work of others, and to follow plans and specifications fixed for him by the supervisors. The latter were authorized also to contract, for a period not exceeding three years, with private parties for the maintenance, repair or improvement of existing roads or the construction of new roads or the building of township bridges. They were further empowered to levy a tax for road purposes of not more than ten mills on the assessed valuation, payable not less than one-fourth nor more than one-half in cash, the remainder in labor if the taxable so elected; and an additional tax not to exceed ten mills might be levied at the option of the Court of Quarter Sessions on petition of the supervisors. The supervisors were also authorized to buy for their township or jointly with those of other townships, for their common use, stone-crushers, rollers and other road-machines and tools necessary for making or repairing roads or bridges. The provisions of this law were effective only when the State should appropriate one million dollars to aid the township road programs, said sum to be administered by the State Department of Agriculture.

The Hamilton road law has undergone several

legislative modifications since 1897, but its main policies remain unchanged.

After a legislative investigation of the methods of organization developed in other states for the building of better roads, the Legislature, by Act of April 15, 1903, created a State Highway Department for the encouragement of better road construction in Pennsylvania. The State Highway Commissioner was required, when so requested by the county commissioners, to make plans for the principal highways, to establish standards, and to encourage a general system of improvement, to apportion any State appropriation for the latter purpose among the applicant localities and, in conjunction with the latter, to contract for highway improvements to be built in stretches of not less than one-fourth mile in length and twelve feet in width. Such highways were to be paid for two-thirds by the State and one-third by the local governments concerned and were to be known as State highways. These were to include any bridges forming part of a road, if such might properly be built under existing laws by the township authorities, but did not involve county bridges. The State Highway Commissioner was charged with the supervision of construction of these roads under contract. The repair of these highways was to be made by the township in which they lay, although State aid for maintenance might be extended from the fund required to be set apart, to 10 per cent of the current appropriation to the Highway Department for road

construction and maintenance. By Act of May 3, 1905, the apportionment of the cost of the road was made three-fourths to the State and one-fourth to the local governments and the unit of construction was increased to not less than one-half a mile in length. The Act specifically provided that for surfacing good materials, such as macadam or telford, should be used. The following Legislature, by Act of June 8, 1907, gave to the State Highway Commissioner the sole power of determining what the material should be for these highways and increased the amount of the State contribution to the maintenance and repair of such roads to 75 per cent of the cost.

In 1911 the Legislature enacted the Sproul Road Act, which took over as State highways a large number of routes connecting the principal towns, the construction, maintenance and repair of which should thereafter be at the sole cost of the State rather than, in part, of the local governments. Provisions were made for the purchase of toll roads forming part of the system, and for the planting of trees and, when desirable, for extending the width of the highways. The same law continued the provisions for the State aid highways previously mentioned, but required that the local governments should thereafter pay one-half of the cost of such roads.

To meet the growing objection of the rural interests that the State contribution to roads had been too largely concentrated on the main highways of

costly macadam or similar construction, the Jones Earth-road Act of June 14, 1911, made separate provision for State aid in the construction of township earth roads. However, the extension of this aid was conditioned on the exercise of considerable supervisory power by the State Highway Commissioner over the local road supervisors, thereafter to be designated as "township supervisors." This law incorporated most of the provisions of earlier acts. By the Act of July 22, 1913, there was created in the State Highway Department the Bureau of Township Highways, which was charged with that fraction of the Commissioner's duties dealing with the execution of the dirt-road law. This very important measure was amended by a law bearing the date of July 16, 1917.

Under these earlier State highway acts it was the intent that such highways should be constructed by contract. The high costs of labor and materials immediately after the close of the Great War led to the failure of many contractors and threatened the progress of the highway work. Moreover, it was considered sound public policy for the State to maintain at that time its public improvements, so as to afford labor for the returned soldier. By a law dated June 7, 1919, the Act of May 31, 1911, was amended so as to authorize the State Highway Commissioner to open quarries, manufacture road-building material, and do everything necessary to enable him to perform his contracts. Consequently, some construction work, as well as all of the main-

tenance of roads already built, has been by labor immediately controlled by the Department.

In order promptly to carry out the extensive program above outlined, an effort was earlier made to secure from the citizens of the Commonwealth an authorization to issue fifty million dollars' worth of bonds, the proceeds of the sale of which should be devoted to such highway construction. The first attempt to secure the requisite public approval failed, but a later trial, initiated immediately thereafter, succeeded in 1918. Consequently, the road construction during the past few years has been very rapid and has gone on consistently despite the high costs of such construction under post-war conditions.

As at present organized, the State Highway Department consists of five divisions:[1] Executive, construction, equipment and transport, office management and automobile, exclusive of various service divisions charged with the duties pertaining to accounting, equipment, road maintenance and purchasing. The automobile division handles, as its name indicates, the registration of motor vehicles and the licensing of drivers.

Under each of the main bureaus an extensive system of branch offices has been created, the duties of

[1] The statements concerning the organization and accomplishments of the State Highway Department are based on information furnished, through the courtesy of Lewis S. Sadler, State Highway Commissioner, by M. H. James, Director of the Extension Bureau of the Highway Department.

whose employees are to care for the work in their assigned districts. For example, the maintenance is conducted under the supervision of superintendents, who have immediate charge of all such work in their respective counties, and who plan and supervise the labor of the permanently employed roadmen. These are usually divided into sections, the sectional groups directed by foremen whose duties require them to maintain the roads of their respective localities in good condition and open for traffic throughout winter and summer. It is the duty of the superintendent to see not only that his employees perform their duties, but that they are suitably and promptly provided with the requisite materials, tools, and machinery therefor.

By the Sproul law and its supplements, 10,300 miles of roads were taken over as State highways. The standard of maintenance has been immensely improved. A system of arteries of transportation, connecting county seats and the principal points of production and consumption respectively, has been surveyed and laid out without regard to local divisional lines. This arterial system is intended to be constructed durably, so that it may be passable for heavy traffic at all times of the year.

The past five years have witnessed a very intense road activity. The Legislatures of 1917, 1919 and 1921 appropriated to the Department from the general treasury $38,649,519.78. The Legislature of 1924 appropriated only $20,000. Fifty million dollars derived from the sale of bonds approved by

the voters in 1918 were utilized to cover the road construction program from 1919 to 1922 inclusive. Federal aid extended to the Commonwealth for the years 1917-23 inclusive amounted to approximately $12,000,000. In 1923 the voters approved a second $50,000,000 bond issue. In addition, the proceeds of automobile licenses are applied by the Department to the maintenance of the highway system. The sums thus collected, including 1917 up to 1924, amounted to approximately $50,000,000.

The local governments have been stimulated to coöperate actively in the construction of subordinate highways collateral with the main State system. The local funds available for such use have been insufficient for the construction undertaken and in the years 1919 and 1920 various counties and townships issued bonds to the amount of $41,114,471 for road and bridge purposes.

In Appendix M are reported the mileages of roads to which the Highway Department has given general repairs, re-surfacing and surface treatment in the seven years from 1917 to 1923.

The construction work in Pennsylvania in 1919 and 1920 has broken all American records for the building of durable highways. The report of construction for such roads of the several types during the years 1917 to 1923 is given in Appendix N.

The results of these improvements on the conditions of communication cannot easily be pictured because of their diversity. The farmer's buggy has almost disappeared from the highways and the

motor-truck is being used in very large numbers for the carriage of farm products to the centers of consumption. Truck- and fruit-farmers remote from the centers of population have gained easy access to good markets at a relatively low freight cost. Interurban transportation, also, has been modified greatly and a very large fraction of the lighter freight formerly conveyed by rail is now carried by motor-trucks to the points of consumption. Motor-bus lines have come into operation all over the State wherever the highways of better quality have been laid down.

The heavy traffic by motor-trucks used for various purposes has resulted in an unexpectedly rapid wear of even the most durably constructed roads. While this has raised economic problems of great importance, the advantages which have accrued from road improvement are so great and so widespread that there can be little doubt of the permanence of the policy of State road construction in Pennsylvania. Its advantageous effects on the economy and social life of the rural communities have been most marked. School and church attendance, shopping and participation by the farmer's family in town amusements have been greatly facilitated.

The second $50,000,000 bond issue was adopted by the voters in 1923. In the expenditure of this money the Pennsylvania Highway Department will build such road types as are demanded by the traffic using the highway on which construction will take place. In order that this may be determined ac-

curately, a traffic census has been taken on all State roads during the last year. The Department is making a study of the future development of the territory through which it will build highways. These investigations cover the future growth in an agricultural, industrial and tourist sense; and when they are completed the Department will have knowledge not only of the traffic which uses the roads at this time, but for a long time to come.

Road construction and maintenance do not sum up all the activities of the Highway Department. It is making an effort to safeguard the lives and property of road-users. Inauguration of the Department's Motor Patrol occurred in 1923 and this force is being increased as rapidly as deemed feasible. In all future construction dividing lines are to be built into the face of the roadway. Warning signs are being erected where necessary. Direction signs are also being placed and signs giving historical facts. The Highway Department's service to the public includes also the furnishing of complete information on road conditions and the existence of detours. Each week it posts conspicuously in 1700 locations a blue print showing the location of detours. This service has never before been attempted by an American commonwealth. During the 1924 season the Highway Department distributed free of charge many thousand copies of a tourist guide to Pennsylvania, which was instructive not only to pleasure seekers and travelers, but to users of commercial vehicles.

CHAPTER XI

THE EDUCATIONAL AND RESEARCH ORGANIZATION OF PENNSYLVANIA

WHILE few of the early colonists were highly educated, they believed in education as evidenced by the establishment of schools among their first activities. The Charity School for the free education of poor children, out of which the University of Pennsylvania has grown, and the Penn Charter School, were two of the earliest founded and have been in almost continuous operation to the present time.

THE PUBLIC SCHOOL SYSTEM

The free school system of the Commonwealth dates from 1834. The public schools are organized at present according to an act of May 18, 1911, commonly known as the School Code.[1] When passed it was said to mark the most advanced step in American educational systems. Well-known educators characterized the law as the "most important, comprehensive and progressive ever enacted."

[1] The School Code of Pennsylvania has been freely quoted without the use of quotation marks.

According to the School Code, each city or incorporated town, borough or township, constitutes a school district. Independent school districts may be established by the Court of Common Pleas, having jurisdiction in the territory. According to the report of the Superintendent of Public Instruction for the year ending July 1, 1923, there were 2,587 districts in Pennsylvania.

Districts are divided into four classes according to population. The cities of Pittsburgh and Philadelphia are of the first class. Districts having a population of less than 500,000 and more than 30,000 are of the second class; those with less than 30,000 and more than 5,000 are of the third class. All districts having a population of less than 5,000 are of the fourth class. There are 2343 fourth class districts in the State.

In districts of the first class fifteen directors are appointed by the judges of the Court of Common Pleas. In the second class districts the directors are nine in number; in the third, seven and in the fourth class five; all chosen for a term of six years at the biennial elections held on odd numbered years. Each board of school directors elects its own officers, consisting of president, vice-president, secretary, and treasurer.

In addition to maintaining a sufficient number of elementary public schools to educate in the common branches every person residing in the district between the ages of six and twenty-one years, the directors also have the power or authority to estab-

lish and maintain high-schools, manual training, vocational, domestic science, agricultural, and evening schools; kindergartens, libraries, museums, reading-rooms, public lectures, gymnasiums, playgrounds, schools for blind and deaf and mentally defective, truant and parental schools and those for

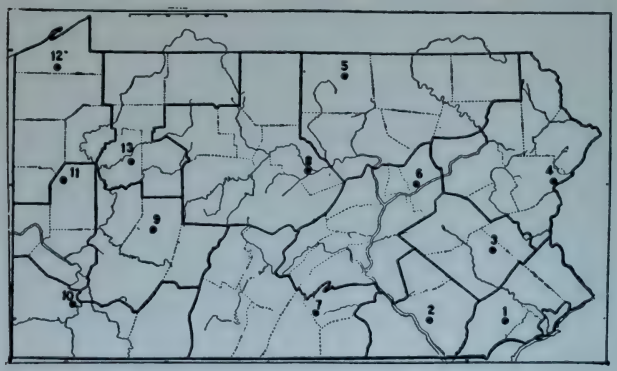

FIG. 32. Location of the various state normal schools.

adults, together with such other schools or vocational departments as they may deem proper to establish. All necessary text-books and supplies are furnished by the districts.

The directors maintain county organizations which convene annually with the county superintendents, for consideration and discussion of questions and subjects pertaining to the welfare of the public schools.

The money appropriated by the State for the public schools is distributed by the Superintendent of Public Instruction, on the basis of the number of teachers employed, kind of certificate held, and property valuation of the district. The regular appropriation to the public schools for the biennial term of 1921-23 was $32,847,000 and for 1923-25, $45,573,000. The taxes required for the schools, in addition to the State appropriation, are levied annually by the boards. Every resident or inhabitant in the school district over twenty-one years of age may be assessed a per capita school tax of one to five dollars in addition to his property. If any resident refuses to pay such a tax, it may be collected from his employer. Eighty per cent of the net receipts and proceeds of the State Forest Reservations, together with all water powers and water rights and escheated estates, go to the State School Fund, which is generally regarded as a wise provision.

The schools of each county are under the supervision of a County Superintendent of Schools who may have one or more assistants, according to the number of schools to be supervised. County superintendents are elected every four years by the directors of the county. Assistant superintendents are elected by the officers of the directors' association on nomination by the superintendent.

Every school district of the first and second class is required to elect a superintendent and every district of the third class is encouraged to elect one. These districts do not participate in the election of

the county superintendent, and are not subject to his supervision.

District superintendents are elected by the directors for a term of four years. Assistant district superintendents are, except in districts of the first class, elected by directors on nomination by the district superintendent. An assistant serves through the term of his superior officer. In 1924 there were sixty-six county superintendents, seventy-two assistant county superintendents, and one hundred and forty district superintendents in Pennsylvania.

Any district of the third or fourth class may employ a supervising principal for all or part of the school unit for a term not to exceed three years, or two or more districts may jointly employ a supervising principal.

The Superintendent of Public Instruction has charge of the supervision of public schools of the State. He prepares the blank forms for reports, and submits to the Legislature an annual report on the condition and needs of the schools. Whenever required, he gives advice and explanations to district officers and citizens.

All township high-schools must give such instruction in agriculture as the Superintendent of Public Instruction prescribes. This should afford an opportunity for connecting the high-schools with the farms of the township. How well this is done depends largely on the attitude of the superintendent and the preparation and the interest of the teacher.

When the controlling object of a high-school in

a rural community becomes the preparation of pupils for profitable or productive employment or occupation in agriculture or home economics, it is class-

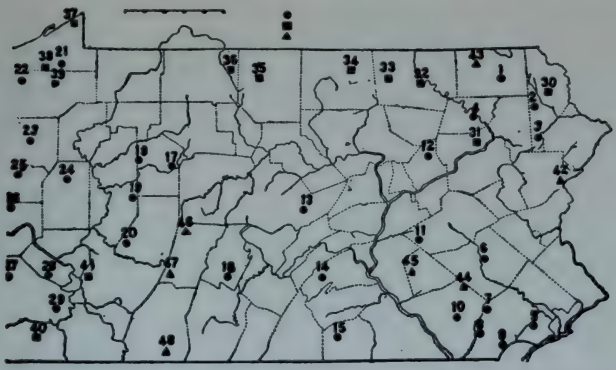

FIG. 33. Location of the rural community vocational schools.

1. Harford; 2. Ariel; 3. Newfoundland; 4. Falls Township; 5. Newtown Square; 6. Ontelaunee; 7. Honey Brook; 8. Cochranville; 9. Avondale; 10. Lampeter; 11. Porter Township; 12. Benton; 13. Spring Mills; 14. Blain; 15. Arendtsville; 16. Martinsburg; 17. Washington Township; 18. Corsica; 19. Dayton; 20. Elders Ridge; 21. Waterford; 22. Conneautville; 23. Fredonia; 24. West Sunbury; 28. Library; 29. Centerville.

Rural Community Vocational Departments.

30. Honesdale; 31. Trucksville; 32. Towanda; 33. Troy; 34. Mansfield; 35. Coudersport; 36. Port Allegheny; 37. North East; 38. Edinboro; 39. Cambridge Springs; 40. Waynesburg; 41. Irwin.

Departments of Home-Making.

42. Stroudsburg; 43. Montrose; 44. Cocalico Township; 45. Palmyra; 46. Barnesboro; 47. Westmont; 48. Meyersdale.

ified as a rural community vocational school (Fig. 33). When the course of study, equipment, buildings, and teachers are approved by the Director of Vocational Education, it is reimbursed by the State and Federal government to the extent of two-thirds of the salaries of all teachers, whether of vocational or general subjects. In 1923-24 the following rural community vocational schools were maintained in the various counties:

NAME OF SCHOOL	COUNTY
Arendtsville	Adams
Avondale	Chester
Benton	Columbia
Blain	Perry
Centerville	Washington
Conneautville	Crawford
Darlington	Beaver
Dayton	Armstrong
East Cocalico	Lancaster
Elders Ridge	Indiana
Findley Twp.	Allegheny
Fredonia	Mercer
Green-Dreher Twp.	Wayne
Gregg Twp.	Center
Halifax	Dauphin
Harford	Susquehanna
Honey Brook	Chester
Lake Twp.	Wayne
Lewisville	Potter
Lower Paxton Twp.	Dauphin
Lykens Valley	Dauphin
Morrison Cove	Blair
Mt. Pleasant Twp.	Washington
New Albany	Bradford
Ontelaunee	Berks
Orangeville	Columbia
Petersburg	Huntingdon
Picture Rocks	Lycoming

NAME OF SCHOOL	COUNTY
Sandy Twp.	Clearfield
Spartansburg	Crawford
South Middleton	Cumberland
Townville	Crawford
Union	Jefferson
Union Twp.	Mifflin
Unionville	Chester
Washington Twp.	Jefferson
Waterford	Erie
West Fallowfield	Chester
West Sunbury	Butler
West Lampeter	Lancaster

These schools are intended to become active community leaders. Around them are to center the social and economic as well as the intellectual life of the community. The teachers are to furnish the inspiration and guidance for promoting the general welfare. Through the project work of the high-school pupils, the adults are reached and interested, and improved methods and practices are often introduced and become established as a consequence.

In addition to the vocational schools and departments just described, in some counties a traveling teacher of agriculture is employed. This teacher visits certain schools at stated periods to give instruction and supervise projects. He is employed by the State through the Bureau of Vocational Education and works in coöperation with the county superintendent. "A part of the time of the county supervisor of agriculture is devoted to carrying on promotional work in the county" under the direction of the assistant director of agricultural educa-

tion. Each county supervisor has at least four high-schools, and gives twenty to twenty-four lessons of ninety minutes each. The schools are for the most part township high-schools of the fourth class.

The agricultural departments and vocational agricultural schools not only give regular four-year courses in agriculture but some of them conduct short-courses for adults of the neighborhood, both in agriculture and household arts. The courses of study take into consideration not alone the fitting of the student to maintain a livelihood, but training for citizenship as well. To this end one-half the time is devoted to the so-called cultural subjects. English is required during the entire four years. United States history and civics are also studied. The remainder of the time may be given to any other academic subject. Algebra is usually recommended, and also some of the natural sciences, such as physics, chemistry, and botany. The ordinary manual training course or school does not come under the vocational education law, nor do courses in cooking and sewing or agriculture as taught in the ordinary high-school course.

The Bureau of Professional Education is a subdivision of the Department of Public Instruction and is under the immediate direction of the Superintendent of Public Instruction. This Bureau regulates the preliminary education, both secondary and collegiate, of those admitted to the practice of medicine, dentistry, and pharmacy. The Bureau of Medical Education has charge of the professional

training of those admitted to the practice of medicine. The Superintendent of Public Instruction and the Commissioner of Health are ex officio members of this Bureau. At least one member must be from the Medical Society of Pennsylvania, one from the Homeopathic Medical Society, and one from the Eclectic Medical Society. All candidates admitted to the practice of medicine must be licensed by this board.

AGRICULTURAL EDUCATION AND RESEARCH

Pennsylvania has no State university in the same sense as have Michigan, Wisconsin, Missouri and other western states. The Pennsylvania State College takes the place of a State university, being supported wholly by appropriations from the State and Federal government. State appropriations are also made to the University of Pennsylvania and to the University of Pittsburgh, and sometimes to other colleges.

The Pennsylvania State College, although not specifically designated by the law as such, is virtually the head of the public school system of the Commonwealth. It is located at State College in Center County, in the geographical center of the State. It was chartered by the Legislature as the Farmers' High School in 1855 and opened for students in February, 1859. In May, 1862, the name was changed to the Agricultural College of Pennsylvania. In 1862 Congress passed the first Morrill Act, setting

apart 30,000 acres of public land for each United States senator and representative for the support of a college. The leading object should be "without excluding other scientific and classical studies and including military science and tactics to teach such branches of learning as are related to agriculture and mechanic arts . . . in order to promote the liberal and practical education of the industrial classes." Pennsylvania's share in these public lands was 780,000 acres.

In 1863 the Legislature accepted the provisions of the land grant and designated the Agricultural College as the recipient of the gift. As the College was much in need of funds at the time, the land was put on the market and sold at a sacrifice. The proceeds of this sale, supplemented by State bonds yields an income of $30,000 a year. In order that it might more accurately express the real purpose and nature of the College, the name was again changed in 1874 and has since remained The Pennsylvania State College.

The income from the Federal government for instructional purposes is the same as in other states, namely, $25,000 each from the second Morrill Act and the Nelson Act. As Pennsylvania has a greater agricultural population than any other state, The Pennsylvania State College receives the greatest income from the Smith-Lever Act for extension work in agriculture and home economics.

For purposes of administration, the work of the College is organized under the following schools and

departments: School of Agriculture and Experiment Station, Institute of Animal Nutrition, School of Engineering and Experiment Station, School of Chemistry and Physics, School of Mines, School of Liberal Arts, School of Education, Department of Physical Education, and Military Organization.

The School of Agriculture gives eleven four-year courses leading to the degree, Bachelor of Science, as follows: agricultural chemistry, agricultural economics, agronomy, animal husbandry, botany, dairy husbandry, forestry, horticulture, landscape-gardening, poultry husbandry, and pre-medical.

Residents of Pennsylvania eighteen years of age or older who cannot enter for four years may be admitted by the Dean of the School to the two-year course in agriculture. The College conducts each year an eight-weeks winter course in agriculture begining about January 1. Agriculture is also taught in the summer session which begins about July and continues six weeks.

Systematic instruction in the correspondence courses in agriculture and home economics is given annually to about 4000 students. Correspondence courses are maintained in forty subjects covering practically every phase of farm activity, including the farm home. Thousands who could not have obtained instruction in any other way have received it through these courses, and hundreds have been stimulated to attend resident classes.

The School of Engineering offers ten four-year courses as follows: architectural, civil, highway,

sanitary, electrical, electro-chemical, industrial, mechanical, milling, and railway mechanical engineering. An Engineering Experiment Station is maintained for investigation and research along scientific and technical lines and for testing materials and products.

The School of Liberal Arts provides three four-year courses leading to the degree of Bachelor of Arts, as follows: arts and letters, commerce and finance, and pre-legal. The course in arts and letters offers a choice of nine major subjects or fields.

The School of Mines offers three courses leading to the degree of Bachelor of Science: metallurgical and mining engineering, and mining geology.

In the School of Chemistry and Physics there are three courses: chemistry, industrial chemistry, physics.

The School of Education gives courses leading to a bachelor's degree in teacher training, education and psychology, agricultural education, industrial education, domestic art, domestic science, and vocational home economics.

The Agricultural Experiment Station, like those in most other states, owes its origin to the passage of a law by Congress in 1888, giving to each land-grant college $15,000 a year for investigations in agriculture. This law is sometimes known as the Hatch Act in honor of William H. Hatch of Missouri who introduced and championed the bill. In 1906, due to the efforts of Henry C. Adams of Wisconsin, a second act was passed, giving an additional $15,000 a year for agricultural research. The Ex-

periment Station is supported by these two funds, by sales and fees, and a small amount from the State appropriation. The work of the Station has included investigations in meteorology, fertilizers, horticulture, forestry, plant diseases, plant-breeding, animal feeding and breeding, dairying, poultry, tillage, lime, and the like. The Station has the most comprehensive as well as the longest continuous set of fertilizer test plats in America. The plats at the College are on Hagerstown loam and were established in 1881. Soil fertility experiments are also conducted at Snow Shoe in Center County on DeKalb soil, at Springfield in Bradford County on Volusia soil, and at Arden, three miles from Washington, Washington County, on Westmoreland soil. The Station also has under way extensive experiments in pomology. A large part of the chemical work incident to the enforcement of the pure food laws is done by the Pennsylvania Agricultural Experiment Station.

The Institute of Animal Nutrition is the only institution of the kind in America. It is fully equipped with every elaborate and accurate apparatus for the investigation of problems in animal nutrition, to which it is exclusively devoted, chiefly with reference to their bearing on economic animal production.

The Smith-Lever Act, passed by Congress in 1914, provides that extension work in agriculture and home economics be carried out by the land-grant colleges of the various states. This field consists of

"the giving of instruction and demonstrations in agriculture and home economics to persons not attending or resident in the college." The funds appropriated by Congress are allotted annually to the different states "in the proportion which the rural population of each state bears to the total rural population of all the states as determined by the next preceding Federal census." Before any state can be paid its allotment for any year, an equal amount must be provided from within. According to the mode of distribution, Pennsylvania received more than any other state.

In order to carry out the provision of this law, a staff of specialists is maintained at the College who are available for consultation and demonstration in any part of the State. This staff includes twenty-six workers in home economics.

One of the most important branches of extension work is the county agent service, through which any county that perfects an organization and provides for its maintenance may have an extension representative whose salary is paid by the State and Federal governments. This agent becomes the local adviser and college representative for the county. Through him the consulting specialists are brought to the county, meetings are held, lectures and demonstrations given, and agricultural information disseminated. In 1924, county agents were employed in all counties except Fulton and Montour, and there were assistant county agents in twelve counties.

The extension department publishes from time to time circulars giving timely instructions in agriculture and home economics. Part of the extension work is the organization and demonstration of boys' and girls' clubs for competition in and study of corn-growing, potato-growing, baking, canning, poultry-keeping, pig-feeding, and kindred subjects of special interest to boys and girls. Among the other activities of the department may be mentioned exhibits at fairs and conventions, the organization of breeding and cow-testing associations, market organizations, judging at fairs, and general agricultural service away from the College.

The Pennsylvania Forest Academy at Mont Alto, Franklin County, was established in 1903 "to prepare thoroughly trained foresters for the service of the State in its forests." The enrollment is limited to residents of Pennsylvania, nineteen to twenty-one years of age. Admission is by competitive examinations including a two-months' probationary period in the woods. The course of study comprises four years of forty-eight weeks each.

The School of Horticulture for Women at Ambler, Montgomery County, is probably the only one of the kind in the country. It is a partially endowed private institution intended to train women in fruit-growing, vegetable-gardening, floriculture, bee-keeping, and poultry-keeping. It is located on a farm of about seventy acres, which serves to furnish practical training. It opened in 1907.

The Industrial and Agricultural School at Down-

ingtown, Chester County, is a private institution of elementary and secondary grade for the training of colored youth.

The National Farm School, opened in 1897 near Doylestown, is a secondary institution intended primarily to give instruction in practical agriculture. It offers a four-year course, which includes English throughout, with some training in history, civics, elementary science, and elementary mathematics. Special stress is laid on farm practice. While it is non-sectarian, its membership has been largely Jewish boys from the cities, many of them foreign-born.

The International Correspondence School of Scranton is a private institution devoted largely to instruction in technical subjects, although the languages and other cultural subjects are also taught. Courses are given in general agriculture, poultry-keeping, and other farm topics.

THE STATE LIBRARY

The State Library and Museum at Harrisburg was made a part of the Department of Public Instruction in 1923. It is the depository of the historical records and of the geological and biological specimens representing the natural history of the State. The library itself contains about 160,000 volumes. According to the report of the State Librarian, there are over 200 exhibits of school work in the education divisions and over 200 exhibits of homes, libraries, public baths, playgrounds, and hos-

pitals. The collection of geological, botanical, and zoological specimens is large.

Closely connected with the State Library is the Free Library Commission, of which the State Librarian is ex officio a member, together with five others appointed by the Governor. The object of this Commission is to advise with the free libraries in different parts of the State and with communities contemplating establishing them, as to selecting books, cataloging, keeping records, and the like.

Traveling libraries are maintained by the Free Library Commission, which are lent free to communities having no other libraries, under certain conditions. Traveling libraries on special subjects are also sent to reading circles, granges, study clubs, literary and scientific societies, schools and others, on request. The Free Traveling Library consists of fifty selected volumes and may be kept by the community or organization six months. Individuals wishing to receive books for their own use on any subject can secure them from the Commissioner.

A summer school for library workers is maintained at State College in connection with the summer session for teachers.

The State Library has a collection of more than 18,000 lantern slides, which are loaned to educational institutions and to individuals who will use them for instructional purposes.

THE RURAL CHURCH

The country church in Pennsylvania, as in all other states, seems to be falling off in membership and influence. This is merely one manifestation of the movement from the country to the city and does not necessarily mean a diminution of spirituality or religious interest among country folk. The surveys of rural churches in certain sections of Pennsylvania indicate a higher percentage of membership among the farming population than in the cities. They also show that, while about one-third of the country churches are stationary, more than one-half are growing if increase in membership can be taken as an index to growth. Those churches which are losing members are in regions in which there has been a strong draft on the community for men to work in the cities or in industrial plants. The shifting nature of the American farming community is responsible for the fluctuation in membership in country churches. The falling off of the congregation in one locality usually means the growth in another. The increase in number due to the recruiting from those outside any church, except in limited localities and at restricted times, is comparatively small.

The salaries paid to country ministers, as to country school teachers, are not sufficient to attract the ablest talent. It is only when the minister is willing to remain for the love of the work and the good of

the cause that the country church can hold the best men. Their good work becomes known to city congregations or others who are financially able to pay a higher salary, and the minister is not to be criticized for accepting.

It has sometimes been deplored that most of the country churches are ministered by young men. While undoubtedly this has its drawbacks, yet there are also advantages. The young men are more able to reach the young persons of the congregation and it is on these that the future of the church must rest. The young minister also is more ambitious and active and able to do an amount of work which many older men could not stand. Further, the young minister, being ambitious, will naturally exert his best efforts, for on his success depends his advancement.

In the cities many organizations allied with the church are striving for its upbuilding. In the country often this is not the case. An agency which bids fair to aid in the upbuilding of the country church and to increase its activity is the county Young Men's Christian Association. In Pennsylvania, Lancaster and Center counties have been partially organized. It is the policy of this movement to organize the young men and boys in local groups in the logical centers of the county. While evangelization is the ultimate aim, this is brought about largely through social activities, community service, and educational work. Bible study forms an essential part of each group. In addition, they may take

up certain work of interest or as the needs of the community seem to warrant. A program of activities is, next to Bible study, essentially needed. Athletics, social clubs, picnics, summer camps, and various outdoor activities are carried on. Throughout all, the fact is not lost sight of that the organization is an auxiliary of the church and not a rival. The educational work and Bible study is intended to supplement the Sunday school, and not to become a competitor of it.

In 1913 the Pennsylvania State Sabbath School Association organized a department of Rural Welfare Work. This concerns itself with the particular problems of the rural Sunday School. It is no part of its purpose to organize new schools, but to help those already in the field. It endeavors to make the whole Sunday School function as an expression of the spiritual life of the community. In its published program, its activities are classified as religious, educational, social, economic, and civic.

AGRICULTURAL SOCIETIES

"As far as is known the first society for promoting agriculture in the United States was established at Philadelphia, then the seat of the General Government, March 1, 1775." [2] It is significant that the members for the most part were not engaged in farming, or the practice of agriculture as a livelihood. The names of George Washington and Ben-

[2] Year-book of the U. S. Dept. Agr. for 1894.

jamin Franklin were among those of the honorary members. The society seems to have led an active existence nearly a hundred years, when it lapsed for want of interest. It was revived under the original charter about 1910 by the late Clarence Sears Kates and a few associates. The Pennsylvania Rural Progress Association was an offshoot of this later revival.

Although the Philadelphia society for promoting agriculture was purely local in its personnel and interests, a committee was appointed by it in 1794 "to prepare outlines of a plan for establishing a state society for the promotion of agriculture." This report contained in one of its alternate plans a suggestion not very dissimilar from the provisions of the Smith-Lever and Smith-Hughes acts. The society sent out a call May 15, 1850, for a convention to be composed of delegates from all the counties to meet in Harrisburg the third Tuesday in January, 1851, for the purpose of effecting a State organization. The convention met January 21, 1851.

The Pennsylvania State Agriculture Society was incorporated March 29, 1851. Its chief activity seems to have been the encouragement of the organization of county societies and the holding of county exhibits or fairs. One of these, though usually different each year, received a greater subsidy than the others and was called the State fair. At a meeting of this society a resolution was passed January 18, 1853, which resulted in the establish-

ment of the Farmers' High School, which afterward became The Pennsylvania State College.

A State Board of Agriculture was established by act of Assembly in 1876. Members served without compensation, but were empowered to appoint and prescribe the duties of a secretary who might receive a salary not exceeding $1,500 a year.

The functions of both the State Agricultural Society and the State Board of Agriculture were gradually absorbed by the State Department of Agriculture established in 1895, and the former were disbanded by law.

The Pennsylvania Dairy Association, established in 1874, was an outgrowth of the Crawford County Dairy Association which was organized three years earlier. It was succeeded by the Dairy Union in 1898. The Live Stock Breeders' Association was organized about the time of the Dairy Union. The two later merged into the Breeders' and Dairymen's Association, which is the organization looking after their interests at the present time.

The Fruit Growers' Association, organized in 1859, became later the Horticultural Association of Pennsylvania. A Vegetable Growers' branch of this organization was added as that interest increased in importance.

Some of the other state-wide organizations active at the present time are: Potato Growers' Association, State Beekeepers' Association, State Poultry Association, Sheep Breeders' and Wool Growers' Association, Threshermen and Farmers' Protective

Association, Tobacco Growers' Association, Society of Farm Women, the State Agricultural Council and the State Conservation Council. Many of these have county or local branches.

When in 1866, Oliver H. Kelley of Itasca, Minnesota, was commissioned to make a tour of the southern states for the purpose of studying agricultural conditions and the needs of the farmers, it is said he found his membership in a certain society of more service to him than his commission from the government at Washington. This led him to conceive of the organization of the farmers, North and South, into a great fraternity.

December 4, 1867, what afterward became the National Grange was organized at Washington and a subordinate grange for practice in the ritual was established soon after, but it was not until April 3, 1868, that any attempt was made to extend the work or to organize a real subordinate grange. On that date Mr. Kelley left Washington for Harrisburg, Pennsylvania, where the first attempt to organize outside of Washington failed. A warrant for a charter was issued to a group but the organization was never completed. After visiting other points in Pennsylvania and New York, a grange was finally established at Fredonia, in the latter state. During that year ten granges were begun. The report for 1870 shows that forty-nine granges had been organized as follows: Minnesota, forty; Illinois, three; Iowa, three; Pennsylvania, one; New York, one; and Ohio, one. The first

grange in Pennsylvania was Eagle Grange No. 1, at Hughesville, Lycoming County.

Pennsylvania has always been among the strongest grange states. There are now about 975 subordinate granges with about 100,000 members (Fig.

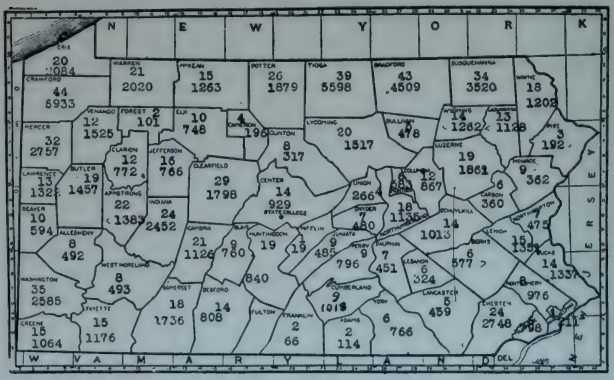

FIG. 34. Showing the number of subordinate granges, as well as grange membership by counties.

34). There are also fifty-seven Pomona granges in Pennsylvania. The Grange has exerted and continues to have a strong influence in social, educational, and agricultural affairs. It has also been a strong factor in molding legislation but has taken no active part in partisan politics. It has consistently stood for the improvement of the country schools and an educated progressive farm community.

The State Grange meets annually in December

and brings together about 2,000 representative farm men and women. The voting delegates, consisting of the masters of the subordinate granges and their wives, probably constitute the most representative agricultural body covering the whole State and the closest to the actual *bona fide* farmers.

The mother chapter of Alpha Gamma Phi, a college fraternity composed of members of the Grange, was organized at The Pennsylvania State College in 1922.

The Keystone Grange Exchange is an organization controlled by the Pennsylvania State Grange for selling farm produce and acting as a contracting and distributing agency for seeds, farm machinery, binder twine, groceries, and the like.

The Grange Mutual Casualty Insurance Company insures members who contribute to it against the liabilities they may have incurred through the Workmen's Compensation Law. It also furnishes accident insurance to the farmer and his family when desired. Twenty-four mutual fire insurance companies are maintained by the Grange in Pennsylvania.

The Alliance was active in parts of Pennsylvania in the early nineties, but most of the locals have been disbanded. The State Alliance still exists and maintains a mutual fire insurance company, and at least one coöperative alliance store has been in continuous successful operation since 1892.

The Gleaners, a fraternal benefit life insurance company for farmers and their families, is popular

in some states and has a few locals known as Arbors in Pennsylvania.

Pennsylvania has no State fair, but an annual farm product show is held late in January each year at Harrisburg under the auspices of the Pennsylvania Department of Agriculture, The Pennsylvania State College, and coöperating organizations. The number of organizations coöperating varies in different years, but, ordinarily, about fifteen to twenty take part. The legislature of 1921 passed an act creating a State Fair Committee with authority to study the problem, present a plan and recommend a site.

Practically every county has agricultural organizations which hold annual fairs or exhibitions, usually in the fall, each year. Seventy-three local and county agricultural societies held exhibits in 1921; those of 1923 are listed in Appendix O. The State duplicates the amount paid for premiums under certain regulations each year up to a maximum of $1,000 for each society. In 1921, these societies paid out in premiums $224,249.32 and were reimbursed by the State to the extent of $55,844.98.

CHAPTER XII

THE RURAL OUTLOOK, AND ESTIMATE

A STUDY of the preceding chapters, and of some closely related questions which are not discussed in this volume, should convince even those who are inclined to be doubtful or cynical concerning the future welfare of the country folk, that the rural outlook is full of encouragement. It must be admitted that there is opportunity for improvement and betterment in many particulars, but the whole general trend is unmistakably forward. In support of this optimistic view of rural tendencies and developments in the Keystone State, it is desirable, in this closing chapter, to analyze or review some of the more important factors.

The farmers of Pennsylvania are engaged in a great commercial industry which rewards them with a gross income of about three-fourths of a billion dollars annually. As important as are the mining and manufacturing interests of the State, agriculture is in the front line of the great business enterprises.

The natural conditions of the State are favorable to the production of a great variety of crops. The

yields of staple crops, fruits and vegetables compare favorably with those of the best agricultural states of the Union. Yields of wheat from thirty to thirty-five bushels to the acre are common, and in many instances the corn crops equal or exceed those of the famous corn-belts of the West.

When a study is made of the soils and climate of Pennsylvania, it is not surprising that the farmer is rewarded with such bountiful crops of a highly diversified character. The limestone valleys are noted for their fertility, and even the thinner soils respond remarkably to proper treatment. The average annual rainfall in most parts of the State exceeds forty inches, and, though crops suffer sometimes for lack of moisture, this is not often a serious handicap to the agriculture. Late spring and early fall frosts cause more or less damage almost every year, but the situation in this respect is probably no worse than in any other eastern state.

The marketing of a three-quarter billion farm crop every year requires the best transportation facilities. The whole State is a network of railroads, so that no farmer is very far remote from a shipping station. Furthermore, as stated in Chapter VIII, Pennsylvania has hundreds of miles of improved highways of the most approved construction, and the system is being rapidly extended in all parts. The State also has thousands of miles of dirt roads which are usually kept in excellent condition, although, as in every state, there are exceptions. With the steam railways, electric roads, and im-

Plate VIII. Above, a field of early cabbage in eastern Pennsylvania. Below, most of the Pennsylvania truckers and market-gardeners use large numbers of hotbed and coldframe sash.

proved highways, it is easy for the farmers to deliver their products to the numerous markets.

The tremendous mining, manufacturing, and railroad interests of Pennsylvania assure the farmer of markets that are unexcelled anywhere in the world. Philadelphia in the east and Pittsburgh in the west afford in themselves outlets of the greatest importance. Besides these two great cities, numerous large ones, such as Reading, Allentown, Harrisburg, Lancaster, York, Wilkes-Barre, Scranton, Williamsport, Erie, Beaver Falls, Butler, Greensburg, McKeesport, Uniontown, Johnstown, Altoona, and scores of other cities and towns require a large supply of farm produce. With the fine system of public highways and by the use of motor-trucks, it is possible for practically every farmer to reach a good market without excessive cost. In this connection attention should be called to the Bureau of Markets of the State Department of Agriculture which is serving, with increasing efficiency, the farmers of the State.

Chapters V and VI discuss in detail the crops of Pennsylvania. It will be noted that the acreage of wheat, corn, oats, and grass was about the same in 1920 as in 1880. Undoubtedly there has been an increase in the acreage of vegetables and special crops, but production has not by any means kept pace with the increasing population, for in 1880 the State had 4,282,891 people and in 1920, 8,720,017. This is strong evidence that the farmers are not measuring up to their opportunities, for thousands

of car-loads of foods are shipped into the State every year. With the rapid growth of the centers of population, undoubtedly there will be an increasing acreage of fruits, vegetables, and special crops which return larger profits to the acre than is possible from the staple farm crops. With all farm crops the tendency will be more and more to apply scientific principles both to production and marketing which will be certain to increase the profits. In this connection, it should be stated that there is a natural tendency among many aggressive farmers to increase the amount of fertilizer applied to the various crops, and this is especially true on the thinner soils. The use of better seed of improved varieties will help to swell farm receipts more than in the past. Also there will be the more perfect control of the numerous insect enemies and diseases which take such a heavy annual toll. The very general and successful spraying of potatoes throughout the State, which has been the development of only three or four years, is an excellent example of progress in this direction.

With the exception of wheat, the general farm crops are marketed very largely through the medium of live-stock. Dairy cattle far outnumber any other class and are of increasing importance in the economics of the State's agriculture. The growing population of cities and the accessibility of great outside markets, such as New York and Baltimore, make the production of market milk very popular on thousands of farms. Although the price of milk is often lower than it should be, it is impossible in

most sections to find any other farm product that yields as satisfactory financial returns. Pennsylvania ranks first in the production of ice-cream and a very large amount of milk is used for this purpose. Excellent progress is being made in the improvement of dairy cattle. Though the Holstein breed predominates, there are many large and well-bred herds of Jerseys, Guernseys, and Ayrshires and some of Brown Swiss. Beef cattle are not bred in such large numbers, although their feeding is important in some counties, and it is believed that the industry could be developed profitably on the lands of lower value, which afford good grazing.

Wherever suitable conditions prevail for the growing of corn, swine husbandry has been profitable. Special progress has been made and will continue in the more economical feeding of swine. The development of the sheep industry is also confidently expected by specialists.

Some striking figures are given in Chapter VII on the importance of poultry in Pennsylvania. With the progress in the science of poultry management, it is believed by many that the 1930 Census will show unusual advancement in this branch of the livestock business.

Pennsylvania is rich in natural resources. Allusion has already been made to its fertile soils. Chapter III calls attention to the depleted timber supply, but, with a State policy of forest fire protection and reforestation, the time should ultimately come when Pennsylvania will almost, if not quite, supply its

own demands for timber. Apparently, there is an almost inexhaustible supply of bituminous and anthracite coal and limestone sufficient for all time. The farmers of the State are especially interested in the supply of limestone, for they are well aware that the application of lime on nearly all the agricultural lands is essential to the most productive cropping. At present, excessive freight rates are a great barrier to the more general and copious use of lime, but it is hoped that lower rates will soon prevail.

It is hoped that the recent organization of the Pennsylvania State Conservation Council will be exceedingly helpful in the conservation of the natural resources of the State. All organizations interested in conservation, such as the State Forestry Society, Sportsmen's organizations, the Grange, State Chamber of Commerce, and a dozen or more other organizations, have representation in the Council. It will speak with authority on legislative matters and in other movements for the advancement of conservation. The State Departments of Forestry, Game and Fish are coöperating and, with a deep state-wide interest in conservation, the outlook is very encouraging. The protection of forests from fire, purchase of additional forest lands, reforestation, and prevention of stream pollution are important measures now before the people.

The Department of Public Instruction of the State Government was completely reorganized a few years ago, very much to the advantage of the school

system of the State. Marked improvement in many of the schools is already noted as a result of more aggressive policies. Increased compensation for properly qualified teachers, closer supervision in all departments, and improvements in the curricula are among the encouraging advancements.

The topographical features of a large area of Pennsylvania are not favorable to the consolidation of the schools. However, the consolidation idea is taking hold in many rural sections, and the public is realizing more and more the handicaps of the one-room school. The improvement of the highways is simplifying the problem of consolidation and there is much less opposition to the centralized school movement than there was a few years ago when the State had a very limited mileage of improved roads.

The agricultural vocational schools are meeting with almost universal favor among the farmers. Surveys show that the communities where such schools have been located for a number of years are generally more progressive and that the farmers who have been trained in these schools are usually successful. It is indeed unfortunate that the funds available for the establishment of agricultural vocational schools fall far short of the demand. It is the judgment of rural leaders that adequate provision should be made for the maintenance of vocational schools, wherever local conditions justify their establishment.

The School of Agriculture of The Pennsylvania State College has a total enrollment of 497 students taking four-year courses, 105 taking the two-year

course, 76 in the winter course, 15 students taking special work, and 34 graduate students. Just previous to the World War, the total enrollment of the School of Agriculture exceeded 1,000. It seems that the schools or colleges of agriculture in nearly every state have suffered a loss in agricultural students, dating from about 1914, but dropping the most rapidly since 1920. Agricultural depression is very clearly reflected in the smaller enrollment of students taking agricultural courses in the land-grant institutions. However, there are many evidences that the low level has been reached. Various business and manufacturing enterprises are calling for the services of college trained men in agriculture, and this demand, together with the usual demands in practical and professional fields, more than justify a large enrollment in agriculture.

It is gratifying that probably 25 to 30 per cent of the graduates of the agricultural colleges choose some branch of farming, orcharding, or vegetable-gardening, as their life vocation. In many instances these young men become rural leaders, and render service of distinct value to their communities and to the great cause of agriculture and better citizenship.

The success of scientific farming in Pennsylvania is assured by the numerous large markets. Practically every farmer is within easy reach of a good market. This very fact may more than justify some radical changes in cropping plans. Farm management studies show that a combination of suitable

general farm crops and well-bred farm animals is the most profitable. While this is true, the writer is confident that more attention should be given to special products, such as fruits, vegetables, flowers, poultry, eggs, turkeys, which are shipped into the State in enormous amounts. In other words, every farmer in Pennsylvania should not only study the adaptations of his land and climate, but also the needs of the markets which he can supply without excessive costs for transportation.

It is probable that certain great changes will occur in cropping systems in the next decade or two. For example, the acreage of alfalfa in Pennsylvania is increasing rapidly. Farmers appreciate more fully its great value both as feed and for soil improvement. It helps to solve the protein problem, and whenever corn, potatoes, or other cultivated crops follow alfalfa, a satisfactory yield is almost certain. In seasons of drought, when the hay crop is short, alfalfa is especially valuable. Dairymen are certain to devote more acres to alfalfa and fewer to wheat.

The slogan among intelligent farmers in the Keystone State is "Economic Production." There is very little tendency to increase the acreage of general farm crops, with the exception of alfalfa and potatoes. With increased and widely disseminated knowledge on potato culture, enabling the farmers to obtain much higher yields, it is certain that Pennsylvania will grow many more potatoes than in the past.

There is practically no tendency as yet to utilize the waste lands of the State for agricultural purposes. In fact, the number of idle farms is increasing probably more rapidly than at any time in the past. Although some of these vacated farms are suitable for cropping, most of them are not very desirable for any type of farming except grazing. The policy of the State government and of many private owners of property is to restore the forests on all such lands. It is a wise policy. Why attempt to cultivate lands that will ultimately pay larger returns from a crop of timber? The Pennsylvania State Conservation Council is conducting a campaign to issue bonds to the extent of $25,000,000 for the purchase of forest lands. The measure was approved by the last Assembly of the Legislature and it is hoped will meet the approval of the people in the General Election of 1925.

Coöperative movements of one kind and another are making progress among the rural population. However, it is believed by most of the rural leaders that standardized production must go hand in hand with coöperative marketing before any considerable progress can be made. Numerous commodity groups have been organized and are operating successfully.

The rural churches, as a whole, have undoubtedly suffered a decline in the past twenty or thirty years, but probably no one knows the extent to which this has influenced the religious life of the country folks. Undoubtedly, there are communities in which a large percentage of the people have lost the church-

going habit, which is keenly regretted. At the same time, it should be noted that rural and urban relationships are much closer than formerly and that, with good roads and the general ownership of automobiles among farmers, perhaps more are attending church in near-by towns or cities. Whatever may be the exact situation today, relative to church attendance by the rural people, it is undoubtedly easier for practically all of them to reach good churches than at any previous time in the history of Pennsylvania.

It is not to be said that because the mining and manufacturing and transportation enterprises of Pennsylvania are extensive and highly developed, the farming is thereby of relative unimportance. In fact, the greater these developments are the more the need for an energetic and organized agriculture. The native soil resources must be developed and conserved. The great populations must be fed and clothed and housed. Materials for a thousand arts may be obtained within the State. The mountains must again be made productive of timber. The rural life is quickened, and the process must be still further stimulated. The State was settled early, but its land resources are yet practically untouched and its agriculture is acquiring a new life.

Statistical Appendices

Appendix A—Monthly temperature and precipitation figures.
Appendix B—Reported production of lumber, by mill classes.
Appendix C—Number of cords of pulpwood used, the average price paid a cord, and the quality of pulp manufactured.
Appendix D—Game killed in Pennsylvania.
Appendix E—Catches by commercial fisheries of Lake Erie.
Appendix F—Agricultural rank of counties based on total acres of crops and animal units.
Appendix G—Rank by counties for several classes of livestock, poultry and eggs.
Appendix H—Acres, production and value of principal crops.
Appendix I—Acres of principal field crops.
Appendix J—Floricultural statistics.
Appendix K—Numbers and value of domestic animals.
Appendix L—Numbers of principal classes of farm animals.
Appendix M—Mileages of roads improved by State Highway Department.
Appendix N—Construction of roads in Pennsylvania.
Appendix O—Organizations holding fairs in 1923 in the counties.

APPENDIX A

Monthly Temperature and Precipitation Figures

	PHILADELPHIA		SOMERSET		MONTROSE		ERIE		STATE COLLEGE	
	Temp.	Prec.	Temp.	Prec.	Temp.	Prec.	Temp.	Prec.	Temp.	Prec.
Jan.	31.8	3.23	26.0	4.53	21.8	3.21	27.2	3.02	26.2	2.8
Feb.	32.8	3.35	26.7	4.12	17.2	4.17	25.8	2.76	25.5	2.73
Mar.	40.	3.43	35.5	4.85	31.7	3.08	33.6	2.72	35.0	3.51
Apr.	50.8	2.92	46.2	6.06	42.3	2.81	44.7	2.59	47.6	3.04
May	62.2	3.30	56.9	5.29	55.4	3.26	56.7	3.58	59.3	4.03
June	71.2	3.27	65.7	4.91	63.2	5.08	66.1	3.58	67.2	4.31
July	75.8	4.14	68.5	4.82	68.1	4.34	71.2	3.10	70.6	4.03
Aug.	73.8	4.69	67.0	4.85	66.5	3.43	69.5	3.37	68.9	4.09
Sept.	67.4	3.36	60.4	3.13	61.6	3.44	63.8	3.51	62.8	2.70
Oct.	56.3	3.01	48.4	2.98	48.4	3.98	52.8	3.81	50.5	2.99
Nov.	44.9	3.11	38.6	3.37	35.2	2.20	41.3	3.29	39.5	2.68
Dec.	35.7	3.07	28.7	4.10	24.9	2.74	31.5	2.88	30.0	2.88

APPENDIX B

Reported Production of Lumber, by Mill Classes in Pennsylvania

Year	Rank of State	Reported cut M ft. b. m.	Total mills reporting	Mills cutting less than 50 M ft.	Class 1 cutting from 50 M to 499 M	Class 2 cutting from 500 M to 999 M	Class 3 cutting from 1,000 M to 4,999 M	Class 4 cutting from 5,000 M to 99,999 M	Class 5 cutting over 10,000 M
1870	2	1,629,631							
1880	2	1,733,844							
1890	3	2,113,267							
1899	4	2,321,284							
1904	6	1,738,972							
1905	7	1,397,164							
1906	9	1,620,881	1482						
1907	8	1,734,729	2132						
1908	10	1,203,041	2224						
1909	14	1,462,771	2974	433	2,065	321	121	12	22
1910	15	1,241,199							
1911	15	1,048,606	1636						
1912	16	992,180	1724						
1913	19	781,547	1159						
1914	19	864,710	1755						
1915	18	622,897	1032						
1916	20	565,895	934	...	754	115	51	4	10
1917	21	501,359	851	...	691	110	37	3	10
1918	20	445,313	719	...	560	117	30	4	8
1919	19	630,471	1529	194	1,097	174	51	5	8
1920	20	401,660	832	...	701	98	22	5	6

APPENDIX C

NUMBER OF CORDS OF PULPWOOD USED IN PENNSYLVANIA, THE AVERAGE PRICE PAID A CORD, AND THE QUANTITY OF PULP MANUFACTURED

Year	Number of mills	Amount of cords	Average price per cord at mill	Estimated quantity of pulp produced Tons
1905	11	250,826	$4.62	123,372
1906	11	282,973	5.59	127,356
1907	16	318,477	6.90	143,663
1908	15	272,980	6.91	124,377
1909	15	295,038	7.25	135,525
1911	14	315,682	....	147,624
1914	..	375,730	....	.....
1916	13	423,843	8.74	216,964
1917	14	415,776	11.23	215,060

APPENDIX D

Game Killed in Pennsylvania

	1921	
	NUMBERS	TOTAL WEIGHT LBS.
Rabbits	3,600,000	7,200,000
Squirrels	500,000	500,000
Ruffed grouse	325,000	487,500
Virginia quail	49,885	18,708
Wild water fowl	46,780	140,340
Woodcock	35,250	13,218
Raccoons	34,200	307,800
Ringneck pheasants	15,400	42,350
Wild turkey	4,654	55,848
Hungarian quail	500	313

The total number of pounds as follows—9,496,757. Reduced to tons, equals 4,748 tons.

The above does not include 22,000 shore birds of various kinds, or 254,000 black birds reported killed.

APPENDIX E

Catches by Commercial Fisheries of Lake Erie

YEAR	POUNDS	VALUE
1893	9,778,600	248,600
1894	9,776,000	234,450
1895	10,644,000	247,325
1896	9,821,500	243,380
1903	7,280,500	300,000
1915	13,583,622	427,200
1916	4,953,799	229,673
1919	13,781,343	1,217,886
1921	11,950,383	574,679

APPENDIX F

THE AGRICULTURAL RANK OF THE 67 COUNTIES OF PENNSYLVANIA BASED ON TOTAL ACRES OF CROPS AND ANIMAL UNITS. AS COMPARED WITH THE RANK BASED ON ACRES OF TEN PRINCIPAL CROPS AND THAT FOR EACH CROP. (BASED ON 1920 CENSUS FIGURES)

COUNTY	AGRICULTURAL RANK	RANK FOR THE CROPS NAMED										
		All 10 Crops	Hay	Silage	Corn	Oats	Wheat	Rye	Buck-wheat	Barley	Potatoes	To-bacco
Lancaster	1	1	4	7	1	24	1	34	57	33	3	1
York	2	2	6	18	2	10	2	12	43	24	2	2
Berks	3	3	8	26	3	1	4	1	55	22	4	5
Chester	4	4	13	5	5	12	7	46	60	34	5	3
Crawford	5	7	2	4	32	5	39	50	2	12	12	—
Bradford	6	6	1	1	46	2	51	21	1	4	11	10
Franklin	7	5	15	25	4	57	3	2	52	6	35	—
Bucks	8	8	11	11	6	11	13	3	42	10	8	—
Washington	9	11	9	13	12	6	10	51	63	17	47	—
Erie	10	13	5	6	38	8	45	31	5	3	7	—
Westmoreland	11	9	10	20	10	4	8	23	32	18	31	—
Tioga	12	14	3	2	53	7	55	55	4	1	25	6
Cumberland	13	10	19	27	7	19	6	14	62	27	29	—
Adams	14	12	22	22	8	46	5	17	58	13	44	13
Montgomery	15	17	18	12	9	28	21	9	50	26	14	—
Mercer	16	16	12	9	25	13	33	30	9	29	19	—
Butler	17	15	14	17	23	9	23	19	7	28	17	—
Somerset	18	18	17	8	34	3	35	29	14	9	13	—
Susquehanna	19	31	7	3	56	32	58	56	18	46	23	—
Greene	20	34	21	59	26	41	32	62	65	58	59	—
Bedford	21	19	34	28	11	23	12	6	8	7	32	—
Lycoming	22	21	26	21	14	14	22	13	11	21	21	7
Indiana	23	20	20	37	24	15	25	5	3	19	26	—
Dauphin	24	22	27	35	13	20	14	37	49	30	27	8
Center	25	23	29	34	15	18	11	44	37	2	36	16
Lebanon	26	28	40	29	16	27	9	42	64	63	30	4
Armstrong	27	26	23	44	27	22	27	16	15	23	37	—

Northampton	28	27	45	33	18	25	17	4	45	11	10	—
Lehigh	29	24	41	57	21	35	15	7	56	57	1	15
Clarion	30	29	25	43	31	16	26	39	12	31	46	—
Northumberland..	31	25	38	36	17	17	16	18	33	54	15	—
Wayne	32	43	16	10	57	52	65	52	22	51	33	—
Allegheny	33	37	30	24	33	29	37	35	54	14	42	—
Huntington	34	35	46	41	20	39	18	27	27	20	43	—
Columbia	35	30	47	50	19	21	20	11	17	37	16	—
Perry	36	33	43	45	22	30	19	32	34	53	49	14
Schuylkill	37	32	39	56	36	33	34	8	30	49	6	—
Fayette	38	38	33	52	28	36	38	48	29	39	55	—
Lawrence	39	41	35	15	41	38	40	36	38	42	54	—
Jefferson	40	36	28	40	44	26	42	25	6	41	28	—
Clearfield	41	39	31	48	45	34	46	22	10	25	20	—
Beaver	42	42	42	32	42	31	41	41	53	47	51	34
Potter	43	47	24	23	65	40	62	61	16	16	18	—
Warren	44	53	36	16	58	50	54	58	24	15	38	—
Snyder	45	40	51	61	29	37	24	28	36	59	39	12
Venango	46	46	32	42	51	43	49	57	13	48	45	—
Luzerne	47	49	48	38	43	47	47	15	23	50	9	—
Cambria	48	44	37	39	52	42	50	24	20	8	22	—
Blair	49	48	52	30	30	48	36	38	39	5	48	—
Juniata	50	45	53	54	35	44	30	43	40	61	52	11
Union	51	50	54	46	39	45	29	45	61	65	56	—
Mifflin	52	51	55	49	37	49	31	54	59	45	60	—
Fulton	53	52	57	63	40	62	28	26	25	35	62	—
Wyoming	54	56	50	14	55	55	61	40	21	44	40	—
Lackawanna	55	59	49	19	62	58	66	53	31	60	24	—
Monroe	56	54	56	58	48	53	53	10	19	40	41	—
McKean	57	58	44	47	66	56	64	65	28	36	53	—
Delaware	58	60	61	31	50	63	48	63	66	38	50	—
Clinton	59	57	60	51	49	54	44	47	48	32	57	9
Montour	60	55	59	55	47	51	43	33	44	43	61	—
Sullivan	61	62	58	53	59	60	59	60	26	52	63	—
Carbon	62	61	63	64	54	59	52	20	35	55	34	—
Elk	63	63	62	60	63	61	60	64	41	56	58	—
Pike	64	64	64	62	61	65	63	49	46	62	65	—
Forest	65	65	65	67	64	64	57	66	47	66	66	—
Philadelphia	66	66	67	66	60	67	56	59	67	64	64	—
Cameron	67	67	66	65	67	66	67	67	51	67	67	—

APPENDIX G

THE RANK BY COUNTIES FOR THE SEVERAL CLASSES OF LIVE-STOCK, POULTRY AND EGGS AS COMPARED WITH THE AGRICULTURAL STATUS AND THAT FOR TOTAL ANIMAL UNITS. (BASED ON 1920 CENSUS FIGURES)

COUNTY	Agricultural Rank	Total Animal Units Rank	RANK FOR LIVE-STOCK NAMED							
			Horses	Mules	Sheep	Swine	Cattle	Dairy cows	Poultry	Eggs
Lancaster	1	1	1	2	24	1	1	2	1	1
York	2	2	5	1	37	2	10	9	2	2
Berks	3	4	4	3	50	3	9	7	3	3
Chester	4	3	3	9	23	8	7	3	6	8
Crawford	5	5	2	34	4	16	6	4	11	10
Bradford	6	6	10	32	5	36	5	1	9	7
Franklin	7	11	6	10	8	4	16	16	8	9
Bucks	8	9	8	19	43	5	25	11	4	5
Washington	9	7	11	23	2	12	3	13	13	19
Erie	10	8	9	33	18	27	13	6	20	12
Westmoreland	11	14	7	15	15	10	11	15	10	11
Tioga	12	12	15	55	7	50	14	8	39	29
Cumberland	13	18	17	5	11	7	23	17	12	14
Adams	14	17	21	4	32	9	15	27	7	6
Montgomery	15	13	13	26	39	6	29	10	5	4
Mercer	16	16	12	28	3	22	8	14	16	15
Butler	17	21	14	41	10	21	18	19	14	13
Somerset	18	19	19	47	16	24	4	22	24	23

Susquehanna	19	10	20	48	17	51	12	5	35	26
Greene	20	15	22	43	1	30	2	52	30	35
Bedford	21	22	24	20	6	14	17	21	22	22
Lycoming	22	23	23	38	42	15	22	18	28	20
Indiana	23	26	16	18	13	25	30	29	23	16
Dauphin	24	24	40	7	56	11	20	24	18	30
Center	25	25	29	24	25	18	21	26	33	36
Lebanon	26	27	36	6	53	17	28	28	19	24
Armstrong	27	29	25	35	22	29	31	33	26	17
Northampton	28	30	27	51	46	20	47	25	15	18
Lehigh	29	32	28	37	59	19	38	36	17	21
Clarion	30	31	31	45	36	33	24	32	41	37
Northumberland	31	35	34	12	51	23	37	34	25	33
Wayne	32	20	18	52	30	53	19	12	37	31
Allegheny	33	28	26	29	31	32	36	23	21	27
Huntingdon	34	33	39	14	21	31	27	40	38	40
Columbia	35	39	33	22	52	13	43	41	32	34
Perry	36	36	45	8	35	28	26	53	29	25
Schuylkill	37	40	37	11	64	26	39	45	27	32
Fayette	38	37	30	42	20	34	33	42	34	39
Lawrence	39	34	32	40	12	41	32	31	43	41
Jefferson	40	44	35	39	38	44	44	51	47	42
Clearfield	41	46	41	25	40	43	42	47	45	47
Beaver	42	42	38	44	9	46	50	38	40	43
Potter	43	41	47	54	14	59	35	30	58	56
Warren	44	38	46	61	29	57	34	20	54	48

APPENDIX G—*Continued*

COUNTY	Agricultural Rank	Total Animal Units Rank	RANK FOR LIVE-STOCK NAMED							
			Horses	Mules	Sheep	Swine	Cattle	Dairy Cows	Poultry	Eggs
Snyder	45	49	48	17	63	35	53	54	36	38
Venango	46	45	43	59	19	48	40	49	49	51
Luzerne	47	43	42	21	47	38	52	39	42	44
Cambria	48	47	44	31	41	40	46	46	46	46
Blair	49	48	49	30	28	37	45	43	52	53
Juniata	50	50	51	13	45	45	49	55	31	28
Union	51	52	50	36	62	47	57	44	44	45
Mifflin	52	51	53	16	34	42	41	56	50	54
Fulton	53	57	54	27	33	49	51	61	53	49
Wyoming	54	54	57	49	44	60	54	35	57	57
Lackawanna	55	53	55	50	49	56	55	37	55	52
Monroe	56	58	56	57	54	54	60	57	48	50
McKean	57	56	58	64	26	61	48	50	61	58
Delaware	58	55	52	46	48	39	59	48	51	55
Clinton	59	59	59	56	57	55	56	58	59	62
Montour	60	60	60	53	61	62	61	59	56	59
Sullivan	61	61	62	62	27	52	58	60	62	63
Carbon	62	63	61	60	67	58	63	63	60	61
Elk	63	62	63	63	65	64	62	62	64	64
Pike	64	64	65	58	60	66	64	64	63	60
Forest	65	66	66	66	55	65	65	66	66	65
Philadelphia	66	65	64	65	66	63	67	65	65	66
Cameron	67	67	67	67	58	67	66	67	67	67

APPENDIX H

ACRES, PRODUCTION AND VALUE OF THE PRINCIPAL CROPS IN PENNSYLVANIA, 1920

CROP	ACRES	UNIT	PRODUCTION	YIELD PER A.	VALUE $
Corn	1,346,404	Bu.	61,450,012	45.6	95,247,521
Oats	1,175,509	Bu.	29,183,172	24.8	26,264,857
Wheat	1,424,951	Bu.	23,453,978	16.5	52,771,466
Rye	242,989	Bu.	3,208,003	13.2	5,293,211
Buckwheat ..	249,654	Bu.	4,755,739	19.0	7,133,626
Barley	13,785	Bu.	261,847	19.0	379,677
Potatoes	233,981	Bu.	22,051,685	94.2	47,411,127
Tobacco	42,799	Lbs.	55,965,851	1308.0	10,073,852
Alfalfa	30,773	Tons	64,326	2.1	1,994,106
Silage Crops .	159,675	Tons	1,590,338	10.0	11,927,547
All Tame Hay	2,865,135	Tons	3,454,641	1.2	92,992,642
Total*	7,754,882				349,495,526

* Does not include alfalfa. It is included in all tame hay.

APPENDIX I

Acres of Principal Field Crops in Pennsylvania

Compiled from U. S. Census Reports

	1880	*1890*	*1900*	*1910*	*1920*
Corn	1,373,270	1,252,369	1,480,833	1,380,671	1,346,404
Oats	1,237,593	1,310,197	1,173,847	1,131,435	1,175,509
Wheat	1,445,384	1,318,472	1,514,043	1,225,558	1,424,951
Rye	398,465	336,041	310,048	272,560	242,989
Buckwheat	246,199	210,488	249,840	292,728	249,654
Barley	23,592	20,950	9,583	7,625	13,785
Potatoes	183,079	191,992	227,867	262,013	233,981
Tobacco	27,566	26,955	27,760	41,742	42,799
All Tame Hay	2,714,909	3,323,689	3,166,809	2,985,363	2,865,135
Alfalfa			52	4,935	30,773
Total	7,650,057	7,991,153	8,160,682	7,604,630	7,625,980

APPENDIX J

Floricultural Statistics

SQUARE FEET OF GLASS — **PENNSYLVANIA RANKS FOURTH**

STATE	NO. SQ. FT. GLASS IN STATE	NO. SQ. FT. GLASS AT COLLEGE OR UNIVERSITY AREA OF FLOWERS ONLY
Illinois	19,600,000	28,000
Ohio	19,400,000	5,600
	(6,000,000 in production of flowers)	
New York	18,300,000	12,165
Pennsylvania	16,900,000	5,600
Maryland	2,200,000	10,000

NUMBER OF ESTABLISHMENTS — **PENNSYLVANIA RANKS SECOND**

New York	2,508
Pennsylvania	2,228
Ohio	1,667
Illinois	1,104

TOTAL VALUE OF PRODUCTION — **PENNSYLVANIA RANKS THIRD**

Illinois	9,978,000
New York	8,689,000
Pennsylvania	8,227,000
Ohio	7,052,000

APPENDIX K

NUMBERS AND VALUE OF DOMESTIC ANIMALS ON PENNSYLVANIA FARMS, 1920

CLASS	NUMBER	VALUE	AVERAGE VALUE
Horses	505,966	$ 60,828,872	$120.22
Mules	55,081	8,172,057	148.36
Beef Cattle	229,745	16,389,069	71.34
Dairy Cattle	1,315,803	106,676,549	81.07
Sheep	508,711	5,192,704	10.21
Goats	2,578	21,567	8.37
Swine	1,190,951	22,111,277	18.57
Poultry	15,226,961	18,639,535	1.22
Total		238,031,631	

APPENDIX L

Numbers of Principal Classes of Farm Animals

	1880	*1890*	*1900*	*1910*	*1920*
Horses	533,587	618,660	590,981	549,756	505,966
Mules	22,914	29,235	38,059	44,323	55,081
Dairy Cows	854,156	927,254	943,773	933,640	885,855
Other Cattle	876,681	779,164	953,074	652,879	659,693
Swine	1,187,968	1,278,029	1,107,981	977,637	1,190,951
Sheep	1,776,598	1,612,107	1,531,066	883,074	508,711
Poultry	7,349,703	11,381,384	11,044,981	16,533,631	15,226,961
Eggs Produced, Dozen	32,982,989	50,049,915	67,038,180	74,729,705	75,998,172
Animal Units	2,852,229	2,954,434	3,076,657	2,667,614	2,569,728
Animal Units per 100 Acres of Crops	37.3	37.0	37.7	35.1	33.7

APPENDIX M

Mileages of Roads Improved by State Highway Department

	State Highway Miles	State Aid Miles	Borough Aid Miles
General Repairs Showing Annual Mileage			
1917	8,405.310	238.812	
1918	8,603.612	352.178	
1919	8,684.583	339.477	14.273
1920	8,435.134	332.624	67.453
1921	8,437.851	399.901	77.307
1922	9,165.797	438.663	125.013
1923	9,210.000	450.000	100.000
	60,942.287	2,551.655	384.046
Resurfacing			
1917	205.355	9.587	
1918	197.098	5.296	
1919	217.614	11.819	62.069
1920	348.780	22.747	41.318
1921	526.391	18.142	15.348
1922	642.242	8.696	15.180
1923	520.000	8.800	15.000
	2,657.480	85.087	148.915
Surface Treatment			
1917	1,391.292	210.513	
1918	1,394.564	142.881	
1919	1,415.952	203.303	62.190
1920	1,329.332	132.659	6.072
1921	1,572.514	193.265	89.698
1922	1,468.824	129.406	104.595
1923	2,700.000	187.000	100.000
	11,272.478	1,199.027	362.555

APPENDIX N

Construction of Roads in Pennsylvania

	1917	*1918*	*1919*	*1920*	*1921*	*1922*	*1923*	TOTAL
Reinforced Concrete	6.64	28.18	175.37	326.78	572.07	460.38	330.07	1,899.49
Brick	.81	8.87	20.24	17.42	20.55	7.96	7.91	83.76
Bituminous Surface		2.44	23.72	47.44	20.72	9.52	36.94	140.78
Sheet Asphalt		3.16	30.42	20.37	50.56	18.57		123.08
Bituminous Macadam					13.45	6.63		20.08
W. B. Macadam	.66	1.29	3.03	1.87	1.26			8.11
Gradings and Drainage	.39	3.03	.32					3.74
	8.50	46.97	253.10	413.88	678.61	503.06	374.92	2,279.04

APPENDIX O

Organizations Holding Fairs or Shows in 1923 in the Counties and Their Locations

Allegheny	Allegheny County Agricultural Association	Imperial, Pa.
Armstrong	Kiskiminetas Valley Agricultural and Driving Association	Apollo, Pa.
Armstrong	Dayton Agricultural and Mechanical Association	Dayton, Pa.
Beaver	Beaver County Agricultural Association	Junction Park, Pa.
Bedford	Bedford County Agricultural Society	Bedford, Pa.
Berks	Agricultural and Horticultural Association of Berks County	Reading, Pa.
Berks	Kutztown Fair Association	Kutztown, Pa.
Blair	Blair County Road Drivers' Association	Altoona, Pa.
Bradford	Bradford County Agricultural Society	Towanda, Pa.
Bradford	Inter-State Fair Association	Athens, Pa.
Bradford	Troy Agricultural Society	Troy, Pa.
Butler	Butler Driving Park and Fair Association	Butler, Pa.
Butler	Chicora Fair Association	Donegal Twp.
Butler	North Washington Agricultural Association	North Washington.
Cambria	Cambria County Agricultural Association, Ltd.	Carrolltown, Pa.
Carbon	Carbon County Industrial Society	Lehighton, Pa.
Centre	Grange Encampment and Fair	Centre Hall, Pa.
Chester	The Chester County Agricultural Association	West Chester, Pa.
Clarion	Clarion County Fair Association	Clarion, Pa.
Clearfield	Clearfield County Agricultural Society	Clearfield, Pa.
Columbia	Columbia County Agricultural, Horticultural and Mechanical Association	Bloomsburg, Pa.

Crawford	Conneaut Lake Agricultural Association	Exposition Park.
Crawford	Oil Creek Agricultural Fair Association	Titusville, Pa.
Dauphin	Gratz Agricultural and Horticultural Association, Inc.	Gratz, Pa.
Elk	Elk County Agricultural Fair Association	St. Marys, Pa.
Erie	Erie Exposition Association	Erie, Pa.
Erie	Wattsburg Agricultural Society	Wattsburg, Pa.
Greene	Greene County Agricultural and Manufacturing Society	Cumberland Twp.
Greene	Waynesburg Fair and Agricultural Association	Waynesburg, Pa.
Huntingdon	Huntingdon County Agricultural Association	Alexandria, Pa.
Indiana	Indiana County Agricultural Society	Indiana, Pa.
Jefferson	Jefferson County Agricultural Association	Brookville, Pa.
Jefferson	Punxsutawney Fair Association	Punxsutawney, Pa.
Juniata	Juniata County Agricultural Society	Port Royal, Pa.
Lackawanna	Lackawanna County Fair and Grange Poultry Association	Clark's Summit, Pa.
Lancaster	Lancaster County Agricultural Fair Association	Lancaster, Pa.
Lawrence	Lawrence County Agricultural Association	Pulaski, Pa.
Lebanon	Lebanon Valley Fair Association	Lebanon, Pa.
Lebanon	Lebanon County Agricultural and Horticultural Association	Lebanon, Pa.
Lehigh	Lehigh County Agricultural Society	Allentown, Pa.
Luzerne	Dallas Union Agricultural Association	Dallas, Pa.
Lycoming	Lycoming County Fair Association	Hughesville, Pa.
McKean	McKean County Fair Association	Smethport, Pa.
Mercer	Mercer Central Agricultural Association	Mercer, Pa.
Mercer	Mercer County Agricultural Society	Stoneboro, Pa.

APPENDIX O—*Continued*

Mifflin	Mifflin County Horticultural and Agricultural Association	Lewistown, Pa.
Monroe	Monroe County Agricultural Society	Stroudsburg, Pa.
Northampton	Northampton County Agricultural Association	Nazareth, Pa.
Northumberland	Milton Fair and Northumberland County Agricultural Association	Milton, Pa.
Perry	Perry County Agricultural Society	Newport, Pa.
Philadelphia	Philadelphia County Fair Association	Byberry, Phila.
Somerset	Meyersdale Fair and Race Association	Meyersdale, Pa.
Somerset	Somerset County Agricultural Society	Somerset, Pa.
Sullivan	Sullivan County Agricultural Society	Forksville, Pa.
Susquehanna	Harford Agricultural Society	Harford, Pa.
Susquehanna	Susquehanna County Agricultural Society	Montrose, Pa.
Susquehanna	Tri-County Agricultural Fair Association	Uniondale, Pa.
Tioga	Cowanesque Valley Agricultural Society	Westfield Twp.
Tioga	Smythe Park Association	Mansfield, Pa.
Union	The Union County Agricultural Society	Lewisburg, Pa.
Venango	Venango County Farmers' and Fruit Growers' Association	Oil City, Pa.
Warren	Warren County Agricultural Association	Warren, Pa.
Washington	Washington Fair Association	Arden, Pa.
Washington	Union Agricultural Association	Burgettstown, Pa.
Washington	West Alexander Agricultural Association	West Alexander, Pa.
Wayne	Wayne County Agricultural Society	Honesdale, Pa.
Wyoming	Wyoming County Fair Association	Tunkhannock, Pa.
York	Hanover Agricultural Society, Inc.	Hanover, Pa.
York	Stewartstown Agricultural Association	Stewartstown, Pa.
York	York County Agricultural Society	York, Pa.

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